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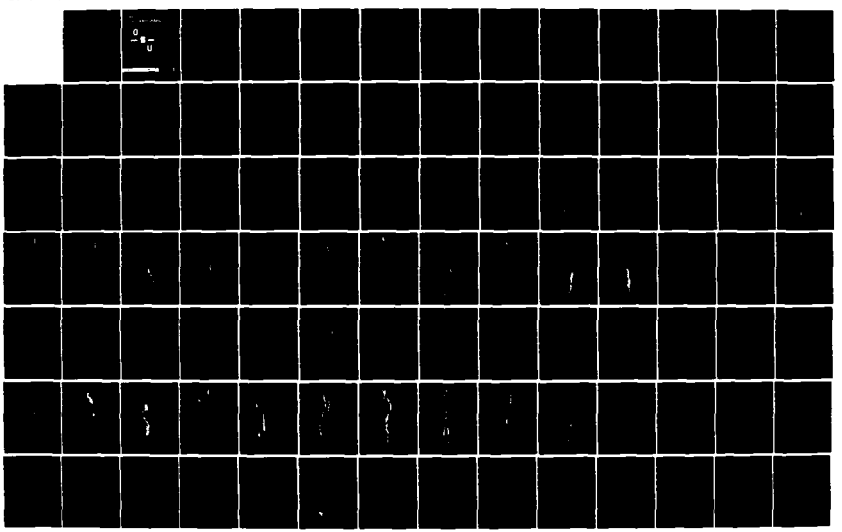

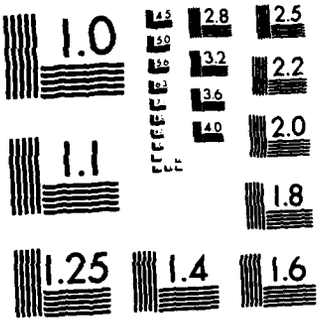

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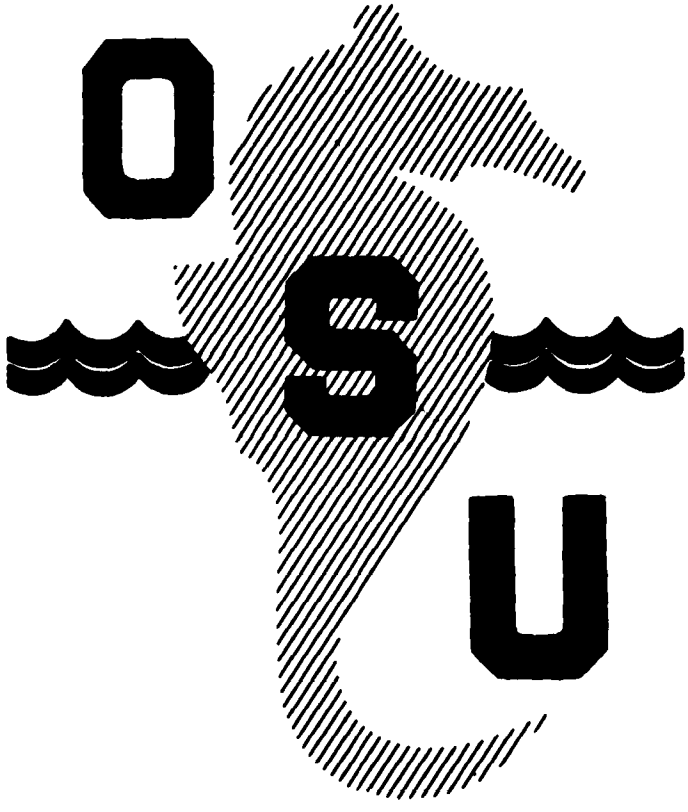

THERMISTOR CHAIN OBSERVATIONS DURING MILDEX

by

Murray D. Levine
Steve R. Gard
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Temperature observations are presented from 4 Aanderaa thermistor chains suspended from a free-floating surface buoy during October-November 1983 near 33.5°N, 126.5°W as part of the Mixed Layer Dynamics Experiment (MILDEX). Each chain contained 11 sensors; the upper two were 30 m in length, the lower two were 100 m long. The shallowest sensor was a 73 m and the deepest at 803 m. Two types of plots of time series are presented for all the data: temperature and isotherm depth.

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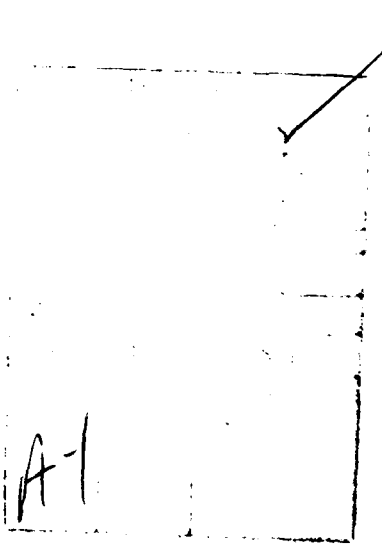

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INTRODUCTION

This report presents observations made with thermistor chains as part of the Mixed Layer Dynamics Experiment (MILDEX) during October-November 1983. The main objective of MILDEX was to monitor the upper ocean and observe its response to atmospheric forcing. Investigators from many institutions aboard the R.V. Wecoma, R.V. Acania, and R.P. Flip made many different types of observations at a variety of horizontal, vertical and temporal scales.

The purpose of the thermistor chains was to provide a continuous time series of the temperature field from the upper ocean through the main thermocline. The major scientific objectives are:

- To describe the high-frequency internal wave field
- To assess the internal tide
- To investigate temperature finestructure and intrusive features

INSTRUMENTATION and DEPLOYMENT

Five Aanderaa thermistor chains, identified as T1, T2, T3, T4 and T5, were deployed along with VMCMs (Vector Measuring Current Meters) on a free-floating Drifter (Fig. 1). The Drifter was buoyed by a toroid surface float which also contained a suite of meteorological sensors, a Loran-C receiver, and a satellite transmitter. A description of the meteorological and current meter data from the Drifter can be found in Richman and deSzoeke (1984).

Each chain contained 11 thermistors evenly-spaced over its length. The three upper chains were 30 m long and the two deeper ones were 100 m in length. The data were recorded on magnetic tape every 5 minutes.

Some of the technical details of the instruments are given in Table 1. T1 recorded at the standard "low" temperature range from -2.5° to 21.5°C. The resolution of the 10 bit recording system is then about 0.023°C. Because the temperature gradient is weaker at depth, the resolution of the deeper instruments was increased by changing resistors in the bridge circuit. During testing a problem caused by self-heating of the thermistors was discovered at the increased resolution. Modified electronic boards (model no. 2167BS), supplied by Aanderaa, were installed in T2, T3, T4, T5, which reduced the self-heating significantly (see Levine (1984) for details).

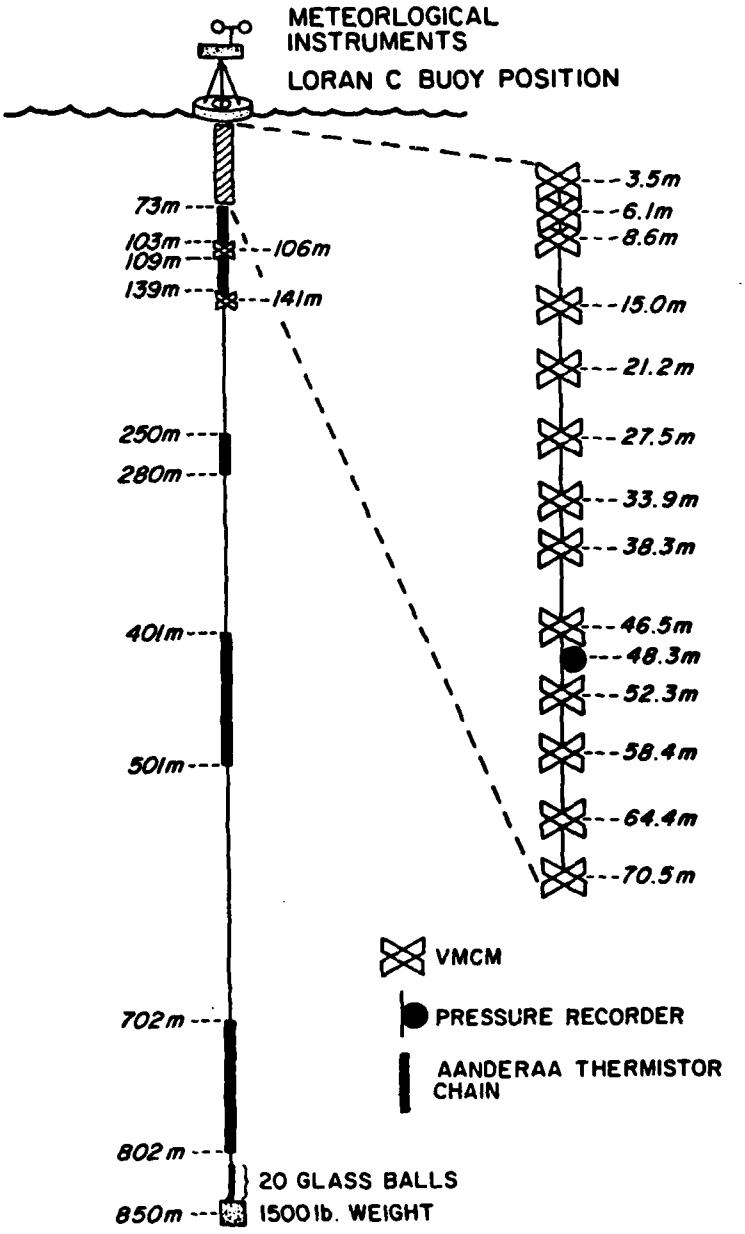


Figure 1. Schematic of Drifter

	Serial No./ Tape No. of TR Recorder	Chain No./ Electronic Board No.	Depth of shallowest-deepest sensor, m	Recorder Configuration		
				Range, °C	Resolution, °C	Bridge Resistors, WR1/WR4, ohms
T1	269/19	689/355*	73-103	-2.5 to 21.5°	0.023°	2000/ 3825
T2	768/6	682/1060**	109-139	5.4 to 17.8°	0.012°	5743/ 3454
T3	265/27	678/1058**	250-280	5.0 to 10.95°	0.0058°	13702/ 4016
T4	8/19	1083/1057**	401-501	4.2 to 7.6°	0.0033°	24850/ 4385
T5	268/20	1084/1059**	702-802	3.1 to 6.0°	0.0019°	29460/ 4657

* Model No. 2167
** Model No. 2167BS

Table 1. Technical information about the Aanderaa thermistor chains deployed during MILDEX.

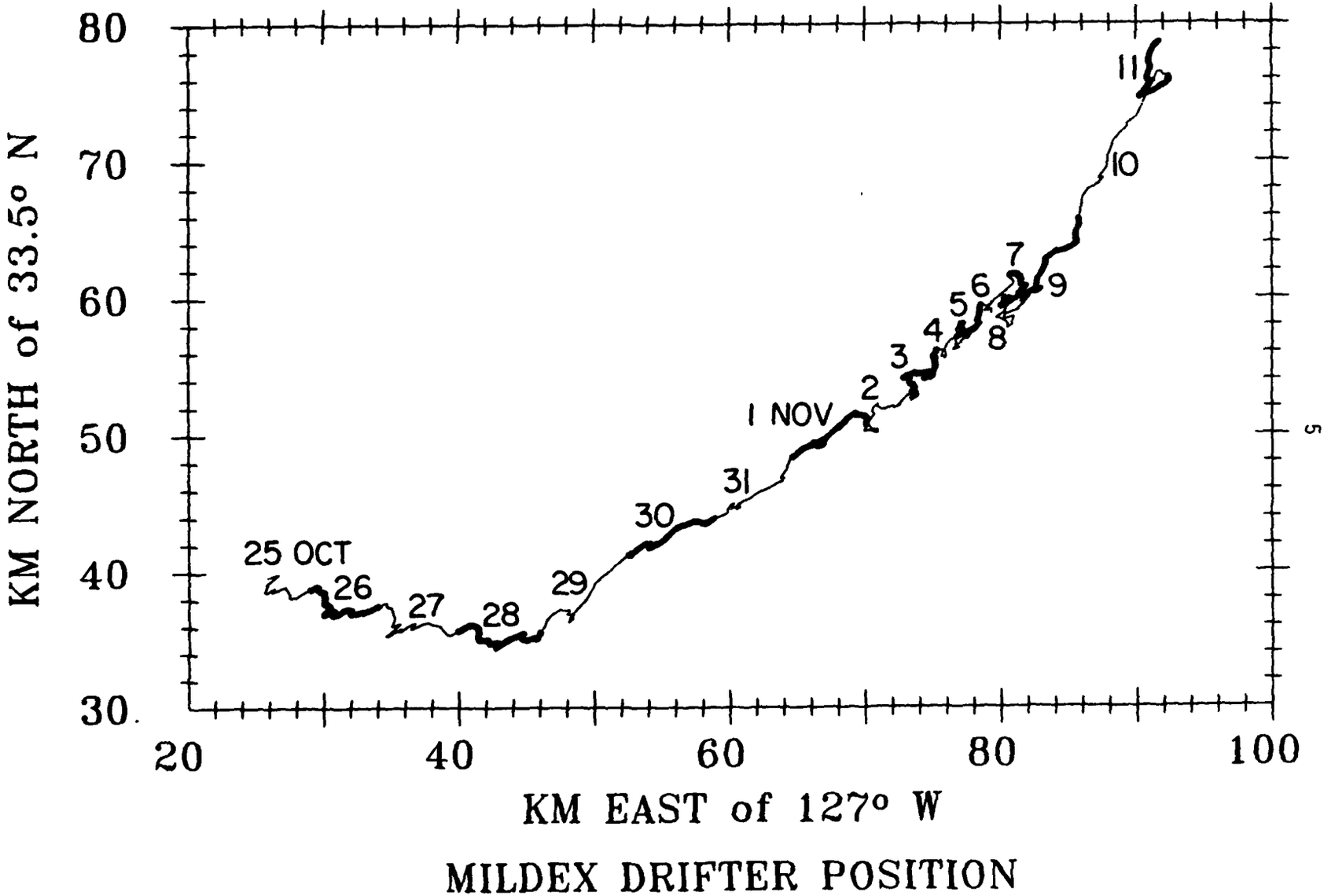
The Drifter was deployed from the R.V. Wecoma at 0007 GMT 25 Oct 1983 near 33° 51' N, 126° 42' W. Data of good quality started at 0100 GMT 25 Oct. The positions of the Drifter, as determined by Loran-C every hour, are shown in Fig. 2. The Drifter traveled to the northwest at an average speed of about 0.06 m/s. Instrument recovery began at 1700 GMT 11 Nov 1983. The longest records contain approximately 399 hours of useful data.

The chains were calibrated both before and after deployment at OSU. To get some idea of the absolute error, the maximum difference between the pre-cruise and post-cruise calibrations over the range the data were recorded is given below:

Chain	T1	0.0092°C
	T2	Leaked
	T3	0.0068°C (except sensor at 253 m, 0.021°)
	T4	0.0048°C
	T5	(see below).

Chains T1, T3, and T4 are probably accurate to within 0.01°C, with the exception of the single sensor at 253 m. A leak in T2 was responsible for introducing low frequency noise into the data; hence no data from this instrument are presented. The middle thermistor in T3 did not function. Due to a mechanical problem, the upper 7 sensors on T4 did not operate for the entire deployment.

Chain T5 exhibited a systematic shift in the calibration as a function of distance of the sensor from the recorder. The sensor nearest the recorder had the same calibration before and after the cruise; the furthest sensor showed nearly a 0.08°C difference. This relatively large shift in the calibration may be associated with the modified electronic board (model no. 2167BS) which is more sensitive to the capacitance of the chain. After the cruise, it was discovered that the recorder apparently has the ability to be in two different calibration "states" reflecting either the pre-cruise or post-cruise calibrations. This mysterious behavior is still under investigation. The data were converted using the post-cruise calibrations because they were the most consistent. However, for the period from 0930 Nov 2 to 1815 Nov 4 the pre-cruise calibrations were used because there were large jumps apparently indicating a change in the "state" of the recorder.



MILDEX DRIFTER POSITION

Figure 2.

OBSERVATIONS

Daily means and variances of the temperature for all sensors are given in Tables 2a-2d.

In order to see the entire time series at a glance, the temperature of a single thermistor from each chain is shown in Fig. 3.

Two types of plots are presented to examine the high frequency oscillations. Both types use the same scale on the time axis--one day per page. The first type displays the temperature time series measured by all the sensors on an individual chain. Usually, temperature decreases with depth, and the plots of temperature from adjacent sensors do not cross. However, there are times when the lines do cross, indicating the presence of a temperature inversion. To aid in identifying these occurrences, areas are shaded where the temperature does not decrease monotonically with depth. In this shaded region it is difficult to identify the plotted temperature with a particular sensor.

The second type of plot shows time series of isotherm depth as drawn by an objective contouring routine. Every data point was used, and the minimum amount of smoothing was chosen. Selected contours are plotted bold to aid in following features from one plot to the next.

ACKNOWLEDGMENTS

The orchestration of the entire Drifter program by James Richman is much appreciated. The Drifter was ably deployed under the direction of Jim Parks. Thanks are extended to Jeffrey Paduan for final instrument preparation and to Dennis Barstow for calibration of the sensors. The cover drawing was kindly provided by Barbara Levine.

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Richman, J.G., and R.A. de Szoeke, 1984: Oregon State University Data Report. (In preparation.)

Table 2a.

THERMISTOR CHAIN T1

Daily Average Temperature (°C) and Standard Deviation (°C)

Depth, m

AVERAGE

	73	76	79	82	85	88	91	94	97	100	103
10/25	12.7725	12.3980	12.0540	11.7218	11.4059	11.1188	10.9314	10.7363	10.5523	10.3805	10.2487
10/26	12.7147	12.3755	12.0366	11.7141	11.4230	11.1663	10.9455	10.7419	10.5695	10.4389	10.3288
10/27	12.5967	12.2800	12.0060	11.7178	11.4249	11.2230	11.0371	10.8600	10.7022	10.5795	10.4925
10/28	12.5905	12.2412	11.8669	11.5694	11.3261	11.1578	11.0443	10.9679	10.8919	10.8174	10.7319
10/29	12.4403	12.0628	11.6958	11.4075	11.2072	11.0552	10.9541	10.8992	10.8330	10.7573	10.6708
10/30	12.5900	12.1942	11.7731	11.4162	11.1787	11.0088	10.9109	10.8613	10.8077	10.7405	10.6745
10/31	12.4525	12.0484	11.7032	11.4189	11.1832	11.0645	10.9766	10.9078	10.8343	10.7539	10.6668
11/ 1	12.2648	11.9113	11.6221	11.3915	11.2310	11.1073	10.9932	10.8978	10.7951	10.7055	10.6102
11/ 2	12.4100	12.0699	11.7670	11.5221	11.2756	11.1060	10.9664	10.8411	10.7471	10.6554	10.5786
11/ 3	12.3373	12.0420	11.7912	11.5478	11.3323	11.1218	10.9503	10.8404	10.7408	10.6501	10.5667
11/ 4	12.4227	12.0868	11.7816	11.5083	11.2742	11.0766	10.9415	10.8339	10.7415	10.6613	10.5801
11/ 5	12.5151	12.1692	11.8667	11.5899	11.3478	11.1140	10.9153	10.7730	10.6584	10.5711	10.4923
11/ 6	12.6852	12.3185	12.0258	11.7573	11.4930	11.1983	10.9432	10.7922	10.6683	10.5746	10.5041
11/ 7	12.6268	12.2935	11.9896	11.7172	11.4855	11.2672	11.0398	10.8553	10.6911	10.5516	10.4335
11/ 8	13.0153	12.5828	12.2540	11.9601	11.6369	11.3581	11.1091	10.9011	10.7259	10.5753	10.4538
11/ 9	13.1449	12.6833	12.2990	11.9950	11.7181	11.4692	11.2390	11.0226	10.8046	10.6184	10.4686
11/10	12.9305	12.5370	12.2230	11.9531	11.6870	11.4477	11.2465	11.1035	10.9683	10.8303	10.7014

STANDARD DEVIATION

10/25	0.4472	0.4075	0.3915	0.3792	0.3232	0.2363	0.2276	0.2403	0.2337	0.2096	0.1669
10/26	0.4261	0.3743	0.3613	0.3560	0.3241	0.2546	0.1903	0.1968	0.1688	0.1461	0.1346
10/27	0.5809	0.5254	0.4740	0.4269	0.3148	0.2363	0.2132	0.2049	0.1964	0.1782	0.1681
10/28	0.5203	0.5332	0.5008	0.4499	0.3289	0.2112	0.1596	0.1327	0.1367	0.1483	0.1416
10/29	0.4203	0.4066	0.3559	0.2467	0.2063	0.1670	0.1312	0.1048	0.1027	0.1171	0.1273
10/30	0.3822	0.3942	0.3887	0.2838	0.2269	0.1508	0.0980	0.0863	0.1049	0.1023	0.0960
10/31	0.4407	0.4466	0.4368	0.3671	0.2831	0.2242	0.1773	0.1518	0.1455	0.1394	0.1346
11/ 1	0.5878	0.5446	0.5324	0.4826	0.4059	0.3252	0.2615	0.2184	0.1996	0.1928	0.2064
11/ 2	0.5496	0.5044	0.4738	0.4407	0.3669	0.3125	0.2660	0.1913	0.1761	0.1705	0.1827
11/ 3	0.5787	0.5493	0.4985	0.4588	0.4044	0.3241	0.2531	0.1901	0.1599	0.1605	0.1631
11/ 4	0.5544	0.5038	0.4643	0.4317	0.3653	0.2793	0.2167	0.1741	0.1504	0.1405	0.1561
11/ 5	0.5480	0.4794	0.4529	0.4303	0.3927	0.3467	0.2850	0.2164	0.1724	0.1464	0.1417
11/ 6	0.3984	0.3096	0.2490	0.2655	0.2730	0.2750	0.2324	0.1905	0.1540	0.1254	0.1244
11/ 7	0.3867	0.3698	0.3532	0.3377	0.3320	0.3372	0.3212	0.2876	0.2702	0.2500	0.2230
11/ 8	0.6046	0.5176	0.4308	0.3950	0.3541	0.3214	0.3160	0.2869	0.2597	0.2415	0.2270
11/ 9	0.6376	0.5951	0.5613	0.4492	0.4121	0.3865	0.3593	0.3543	0.3404	0.2953	0.2557
11/10	.5505	0.3959	0.3343	0.3266	0.3289	0.2929	0.2537	0.2281	0.2120	0.1895	0.1770

Table 2b.

THERMISTOR CHAIN T3

Daily Average Temperature (°C) and Standard Deviation (°C)

Depth, m

AVERAGE

	250	253	256	259	262	265	268	271	274	277	280
10/25	8.1242	8.1146	8.0615	8.0317		7.9735	7.9332	7.8940	7.8440	7.7969	7.7402
10/26	8.1172	8.1083	8.0602	8.0376		7.9877	7.9558	7.9221	7.8884	7.8487	7.8028
10/27	8.1257	8.1170	8.0716	8.0509		7.9972	7.9606	7.9159	7.8587	7.8040	7.7461
10/28	8.1291	8.1277	8.0860	8.0690		8.0148	7.9764	7.9349	7.8851	7.8373	7.7837
10/29	8.1677	8.1469	8.0838	8.0369		7.9484	7.8977	7.8464	7.7885	7.7299	7.6683
10/30	8.0126	7.9834	7.9144	7.8664		7.7838	7.7491	7.7228	7.6978	7.6817	7.6623
10/31	7.8957	7.8708	7.8121	7.7765		7.7218	7.6964	7.6742	7.6436	7.6093	7.5749
11/ 1	7.9584	7.9434	7.8856	7.8502		7.7749	7.7409	7.7090	7.6722	7.6375	7.6025
11/ 2	7.9120	7.8967	7.8376	7.7984		7.7362	7.7089	7.6855	7.6518	7.6175	7.5796
11/ 3	7.9374	7.9167	7.8589	7.8184		7.7439	7.7075	7.6731	7.6417	7.6161	7.5710
11/ 4	7.9072	7.9012	7.8443	7.8096		7.7277	7.6873	7.6555	7.6231	7.5908	7.5522
11/ 5	7.9071	7.8827	7.8214	7.7949		7.7251	7.6840	7.6481	7.6131	7.5827	7.5529
11/ 6	7.9501	7.9183	7.8503	7.7988		7.7309	7.6986	7.6713	7.6336	7.6002	7.5648
11/ 7	8.1164	8.0930	8.0235	7.9757		7.8915	7.8447	7.8021	7.7567	7.7106	7.6656
11/ 8	8.0574	8.0378	7.9775	7.9386		7.8609	7.8197	7.7992	7.7691	7.7393	7.7122
11/ 9	8.0895	8.0603	7.9826	7.9422		7.8955	7.8824	7.8775	7.8517	7.8183	7.7714
11/10	8.1084	8.0810	8.0167	7.9669		7.8641	7.8034	7.7405	7.6797	7.6217	7.5611

STANDARD DEVIATION

10/25	0.0816	0.0864	0.0861	0.0839	0.0892	0.0965	0.1028	0.1136	0.1300	0.1511
10/26	0.0828	0.0776	0.0710	0.0690	0.0782	0.0858	0.0948	0.0979	0.1139	0.1245
10/27	0.0976	0.0846	0.0750	0.0739	0.1043	0.1188	0.1369	0.1553	0.1688	0.1761
10/28	0.0883	0.0746	0.0638	0.0622	0.0835	0.0982	0.1142	0.1267	0.1353	0.1454
10/29	0.0939	0.1096	0.1232	0.1350	0.1499	0.1603	0.1641	0.1593	0.1568	0.1476
10/30	0.1918	0.1911	0.1816	0.1588	0.1102	0.0876	0.0765	0.0764	0.0788	0.0836
10/31	0.1551	0.1463	0.1320	0.1123	0.0816	0.0727	0.0737	0.0776	0.0872	0.0953
11/ 1	0.1034	0.1067	0.1075	0.1011	0.0848	0.0795	0.0795	0.0791	0.0744	0.0690
11/ 2	0.1481	0.1440	0.1398	0.1333	0.1329	0.1372	0.1364	0.1332	0.1186	0.1097
11/ 3	0.1774	0.1664	0.1611	0.1446	0.1269	0.1178	0.1084	0.0985	0.1002	0.1296
11/ 4	0.1509	0.1536	0.1493	0.1442	0.1322	0.1376	0.1412	0.1459	0.1589	0.1779
11/ 5	0.2367	0.2118	0.1965	0.2030	0.1814	0.1654	0.1485	0.1418	0.1385	0.1381
11/ 6	0.2689	0.2505	0.2331	0.2044	0.1692	0.1542	0.1445	0.1374	0.1399	0.1447
11/ 7	0.2449	0.2488	0.2536	0.2544	0.2516	0.2495	0.2508	0.2586	0.2660	0.2704
11/ 8	0.2423	0.2367	0.2168	0.1986	0.1764	0.1616	0.1483	0.1373	0.1358	0.1307
11/ 9	0.1564	0.1518	0.1422	0.1384	0.1415	0.1410	0.1412	0.1391	0.1371	0.1352
11/10	0.1771	0.1664	0.1516	0.1311	0.1172	0.1314	0.1509	0.1691	0.1763	0.1780

Table 2c.

THERMISTOR CHAIN T4

Daily Average Temperature (C°) and Standard Deviation (°C)

Depth, m

AVERAGE

	401	411	421	431	441	451	461	471	481	491	501
10/25	6.0583	5.9766	5.8891	5.8139	5.7172	5.6263	5.5361	5.4706	5.4228	5.3726	5.3214
10/26	6.0529	5.9840	5.9012	5.8288	5.7399	5.6584	5.5674	5.4902	5.4359	5.3922	5.3400
10/27				5.8229	5.7420	5.6652	5.5909	5.5223	5.4675	5.4129	5.3612
10/28				5.8430	5.7735	5.6947	5.6195	5.5375	5.4737	5.4084	5.3459
10/29				5.8550	5.7761	5.7107	5.6440	5.5616	5.4986	5.4427	5.3626
10/30					5.7988	5.7260	5.6477	5.5715	5.4878	5.4162	5.3298
10/31					5.8252	5.7707	5.6935	5.6172	5.5516	5.4814	5.4115
11/ 1					5.8577	5.8000	5.7100	5.6294	5.5717	5.5113	5.4423
11/ 2					5.8485	5.7827	5.6942	5.6134	5.5490	5.4918	5.4298
11/ 3					5.8275	5.7816	5.7130	5.6280	5.5582	5.4836	5.4164
11/ 4						5.7839	5.7128	5.6322	5.5550	5.4853	5.4091
11/ 5							5.6859	5.6223	5.5554	5.4956	5.4211
11/ 6							5.6769	5.6146	5.5542	5.4910	5.4169
11/ 7							5.6186	5.5683	5.5179	5.4650	5.4113
11/ 8							5.5966	5.5223	5.4569	5.4154	5.3824
11/ 9							5.6244	5.5781	5.5304	5.5010	5.4404
11/10							5.7279	5.6793	5.6418	5.6250	5.5980

STANDARD DEVIATION

	401	411	421	431	441	451	461	471	481	491	501
10/25	0.0807	0.0619	0.0674	0.0839	0.0878	0.0790	0.0771	0.0687	0.0632	0.0625	0 0657
10/26	0.0718	0.0665	0.0641	0.0662	0.0722	0.0641	0.0598	0.0563	0.0480	0.0487	0.0450
10/27				0.0819	0.0863	0.0844	0.0754	0.0689	0.0600	0.0572	0.0534
10/28				0.0843	0.0864	0.0859	0.0819	0.0792	0.0686	0.0687	0.0757
10/29				0.0739	0.0711	0.0632	0.0631	0.0671	0.0705	0.0788	0.0846
10/30					0.0723	0.0783	0.0779	0.0832	0.0863	0.0877	0.0859
10/31					0.0464	0.0618	0.0544	0.0497	0.0657	0.0708	0.0727
11/ 1					0.0555	0.0608	0.0694	0.0564	0.0526	0.0652	0.0598
11/ 2					0.0700	0.0764	0.0719	0.0672	0.0674	0.0639	0.0538
11/ 3					0.0729	0.0893	0.0906	0.0982	0.1014	0.1035	0.0860
11/ 4						0.0966	0.1042	0.1062	0.1061	0.0966	0.0811
11/ 5							0.1091	0.1169	0.1245	0.1256	0.1259
11/ 6							0.1120	0.1114	0.1112	0.1154	0.1311
11/ 7							0.0802	0.0716	0.0804	0.0894	0.0955
11/ 8							0.1193	0.1239	0.1025	0.0752	0 0541
11/ 9							0.0761	0.0794	0.0754	0.0774	0.0699
11/10							0.0826	0.0955	0.1138	0.1322	0.1347

Table 2d.

THERMISTOR CHAIN T5

Daily Average Temperature (°C) and Standard Deviation (°C)

AVERAGE	Depth, m										
	702	712	722	732	742	752	762	772	782	792	802
10/25	4.7416	4.7247	4.6914	4.6407	4.6160	4.5802	4.5652	4.5272	4.4921	4.4734	4.4482
10/26	4.7295	4.7251	4.6997	4.6452	4.6143	4.5759	4.5571	4.5334	4.5005	4.4698	4.4438
10/27	4.6451	4.6368	4.6247	4.5927	4.5830	4.5405	4.5160	4.4828	4.4571	4.4352	4.4141
10/28	4.6218	4.6027	4.5770	4.5399	4.5163	4.4889	4.4800	4.4646	4.4329	4.4133	4.3955
10/29	4.6083	4.5938	4.5873	4.5544	4.5379	4.5051	4.5002	4.4712	4.4436	4.4173	4.3905
10/30	4.6159	4.5926	4.5642	4.5228	4.5071	4.4776	4.4639	4.4385	4.4141	4.4036	4.3951
10/31	4.6193	4.5896	4.5639	4.5198	4.4994	4.4671	4.4540	4.4256	4.3997	4.3849	4.3718
11/ 1	4.5902	4.5650	4.5516	4.5176	4.5027	4.4708	4.4505	4.4135	4.3806	4.3569	4.3386
11/ 2											
11/ 3											
11/ 4											
11/ 5	4.5865	4.5445	4.5044	4.4426	4.4214	4.3796	4.3451	4.2939	4.2717	4.2552	4.2191
11/ 6	4.5552	4.5276	4.4913	4.4293	4.4104	4.3669	4.3361	4.2890	4.2729	4.2620	4.2309
11/ 7	4.5844	4.5457	4.4988	4.4334	4.4117	4.3661	4.3341	4.2838	4.2609	4.2475	4.2179
11/ 8	4.6464	4.5976	4.5403	4.4637	4.4253	4.3731	4.3361	4.2829	4.2646	4.2544	4.2237
11/ 9	4.6186	4.5711	4.5252	4.4621	4.4402	4.3905	4.3563	4.3073	4.2840	4.2671	4.2326
11/10	4.7461	4.7020	4.6530	4.5799	4.5527	4.5065	4.4712	4.4094	4.3760	4.3445	4.2964
STANDARD DEVIATION											
10/25	0.0366	0.0451	0.0524	0.0448	0.0443	0.0425	0.0426	0.0388	0.0376	0.0384	0.0394
10/26	0.0554	0.0543	0.0542	0.0481	0.0437	0.0432	0.0428	0.0447	0.0474	0.0540	0.0531
10/27	0.0521	0.0591	0.0637	0.0634	0.0594	0.0577	0.0513	0.0404	0.0368	0.0367	0.0357
10/28	0.0389	0.0351	0.0364	0.0361	0.0364	0.0413	0.0432	0.0410	0.0399	0.0319	0.0278
10/29	0.0384	0.0329	0.0332	0.0380	0.0382	0.0375	0.0315	0.0307	0.0328	0.0379	0.0411
10/30	0.0523	0.0456	0.0385	0.0390	0.0396	0.0398	0.0403	0.0425	0.0406	0.0337	0.0306
10/31	0.0603	0.0489	0.0383	0.0346	0.0392	0.0397	0.0377	0.0355	0.0354	0.0364	0.0392
11/ 1	0.0477	0.0399	0.0367	0.0337	0.0361	0.0419	0.0457	0.0486	0.0434	0.0421	0.0447
11/ 2											
11/ 3											
11/ 4											
11/ 5	0.0727	0.0552	0.0481	0.0491	0.0524	0.0540	0.0481	0.0441	0.0449	0.0479	0.0534
11/ 6	0.0472	0.0405	0.0380	0.0403	0.0442	0.0427	0.0363	0.0356	0.0378	0.0408	0.0446
11/ 7	0.0746	0.0621	0.0512	0.0468	0.0453	0.0438	0.0415	0.0420	0.0431	0.0458	0.0472
11/ 8	0.0668	0.0723	0.0681	0.0671	0.0591	0.0520	0.0429	0.0352	0.0321	0.0382	0.0390
11/ 9	0.0645	0.0564	0.0527	0.0526	0.0542	0.0507	0.0535	0.0560	0.0577	0.0568	0.0569
11/10	0.0654	0.0555	0.0473	0.0435	0.0412	0.0413	0.0461	0.0469	0.0505	0.0570	0.0613

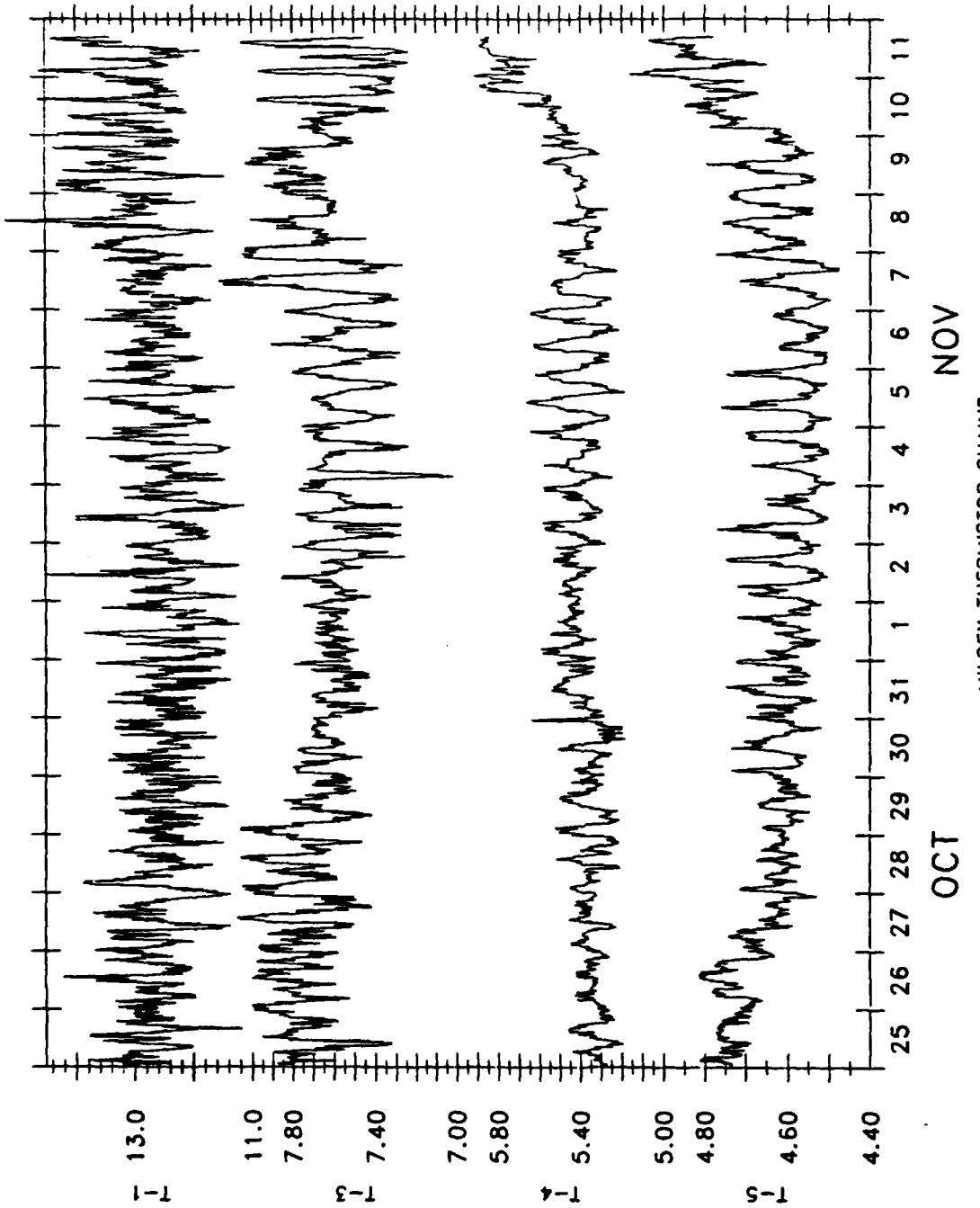
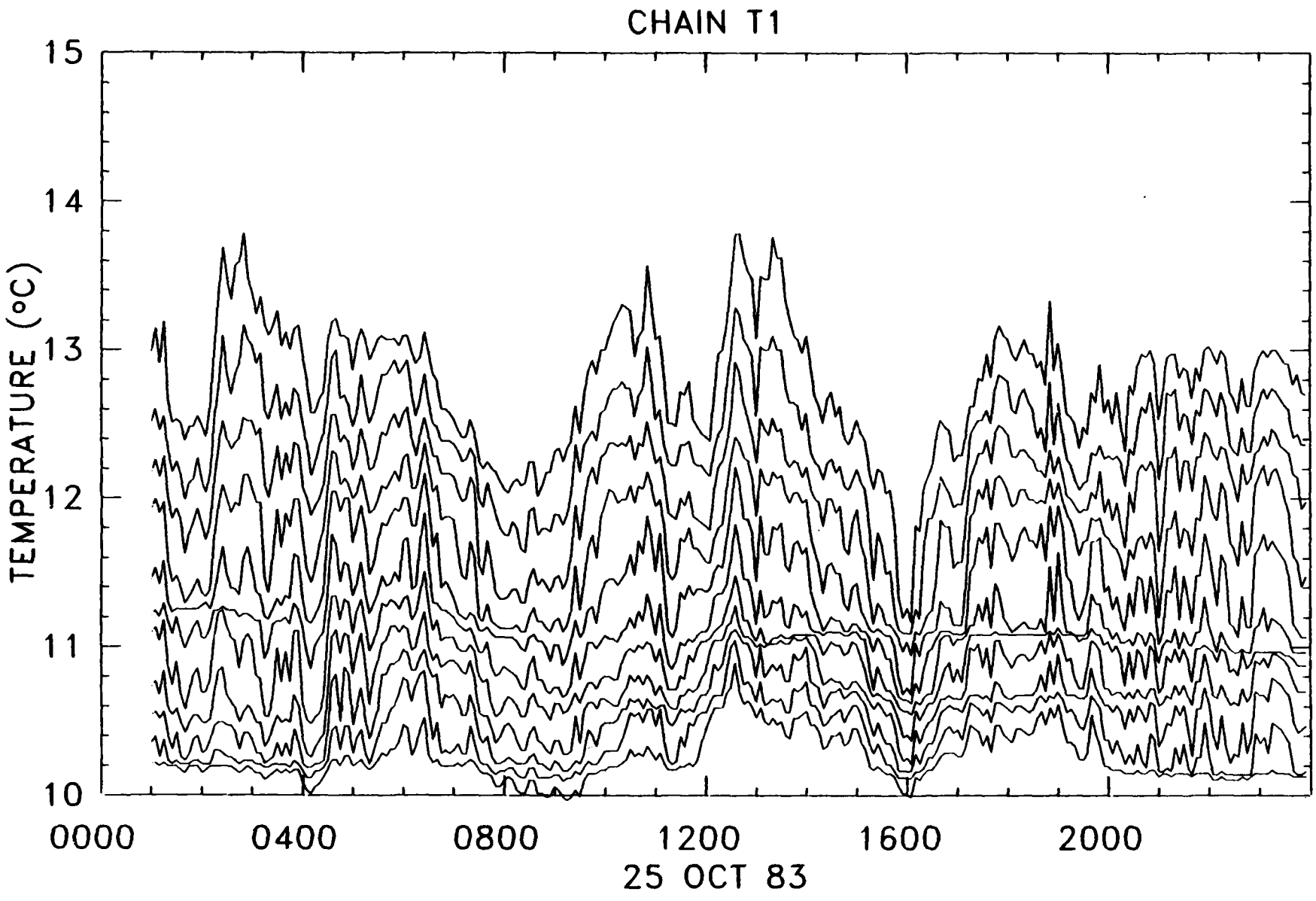


Fig. 3. Temperature as a function of time from a single thermistor on each chain. The depth of the sensors are, from top to bottom, 73, 280, 501, and 702 m.

TIME SERIES of TEMPERATURE

On the following pages there are plots of the temperature from each sensor as a function of time for Chains T1, T3, T4 and T5. The depths of the sensors can be inferred from Table 1. When lines cross, a temperature inversion is present, and it is difficult to identify the plotted line with a particular sensor. To aid in identifying these occurrences, areas are shaded where the temperature does not decrease monotonically with depth.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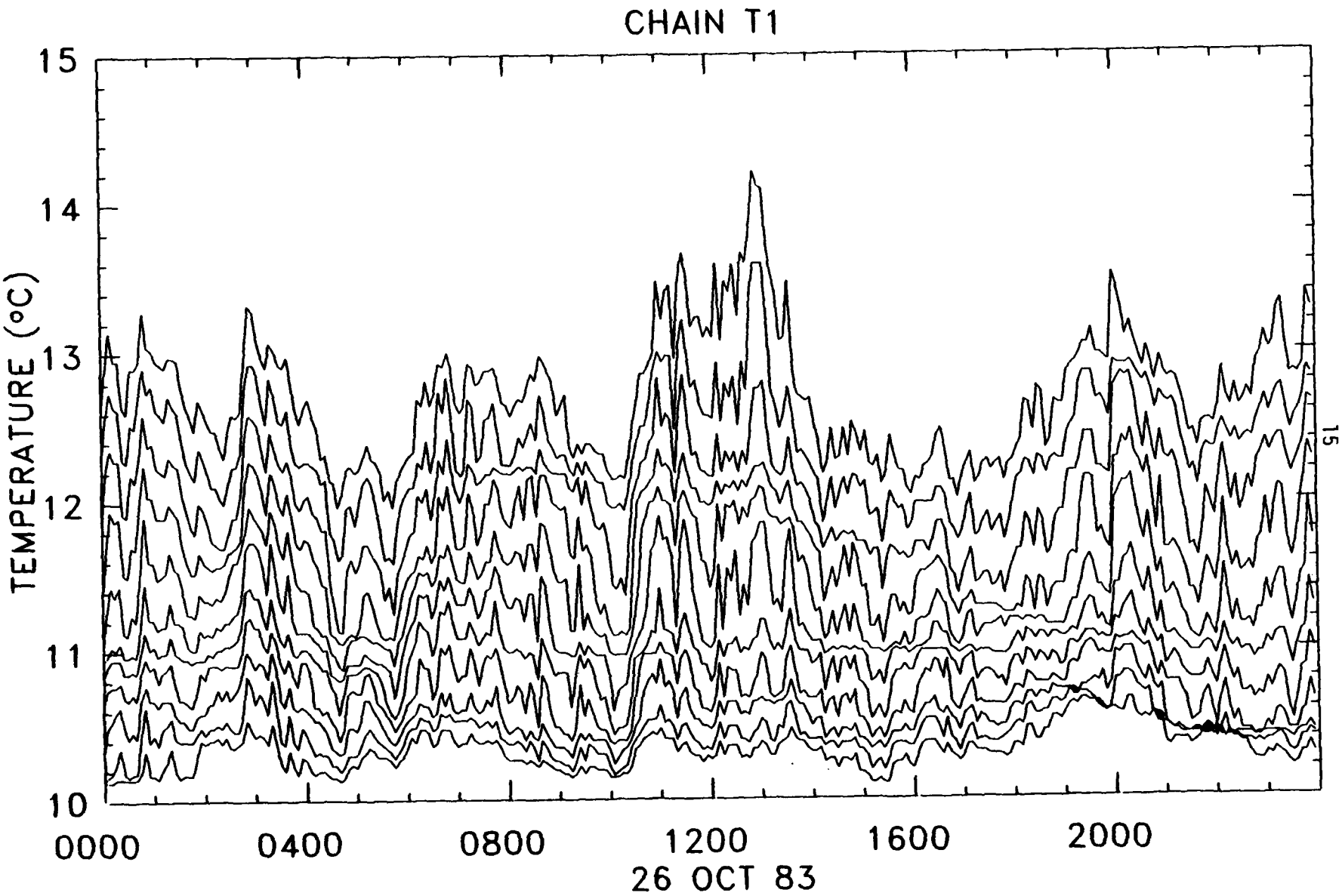
15
14
13
12
11
10
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
25 OCT 83


CHAIN T1
15
14
13
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11
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TEMPERATURE (°C)
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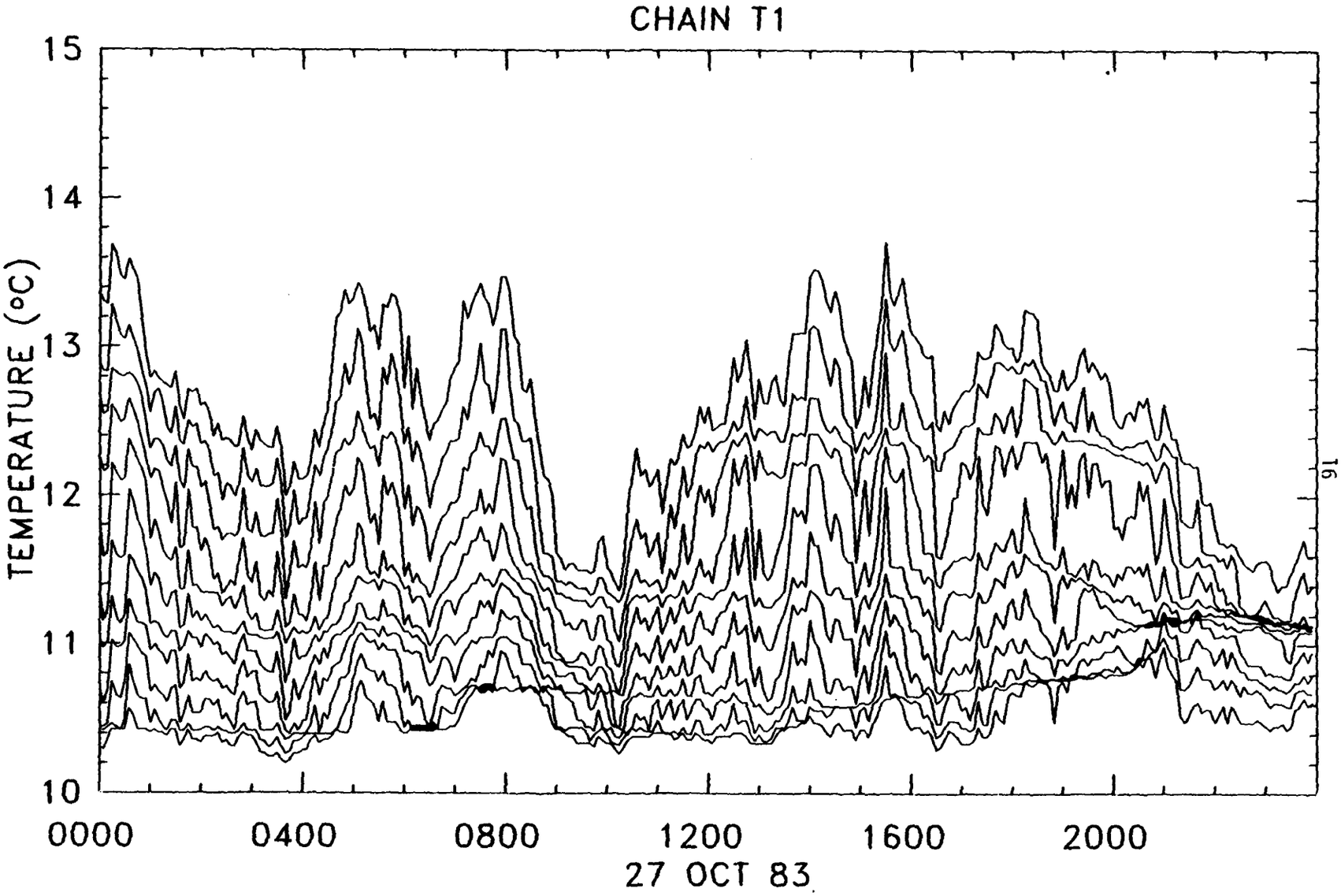
1200
1600
2000
26 OCT 83
15


CHAIN T1
TEMPERATURE (°C)
15
14
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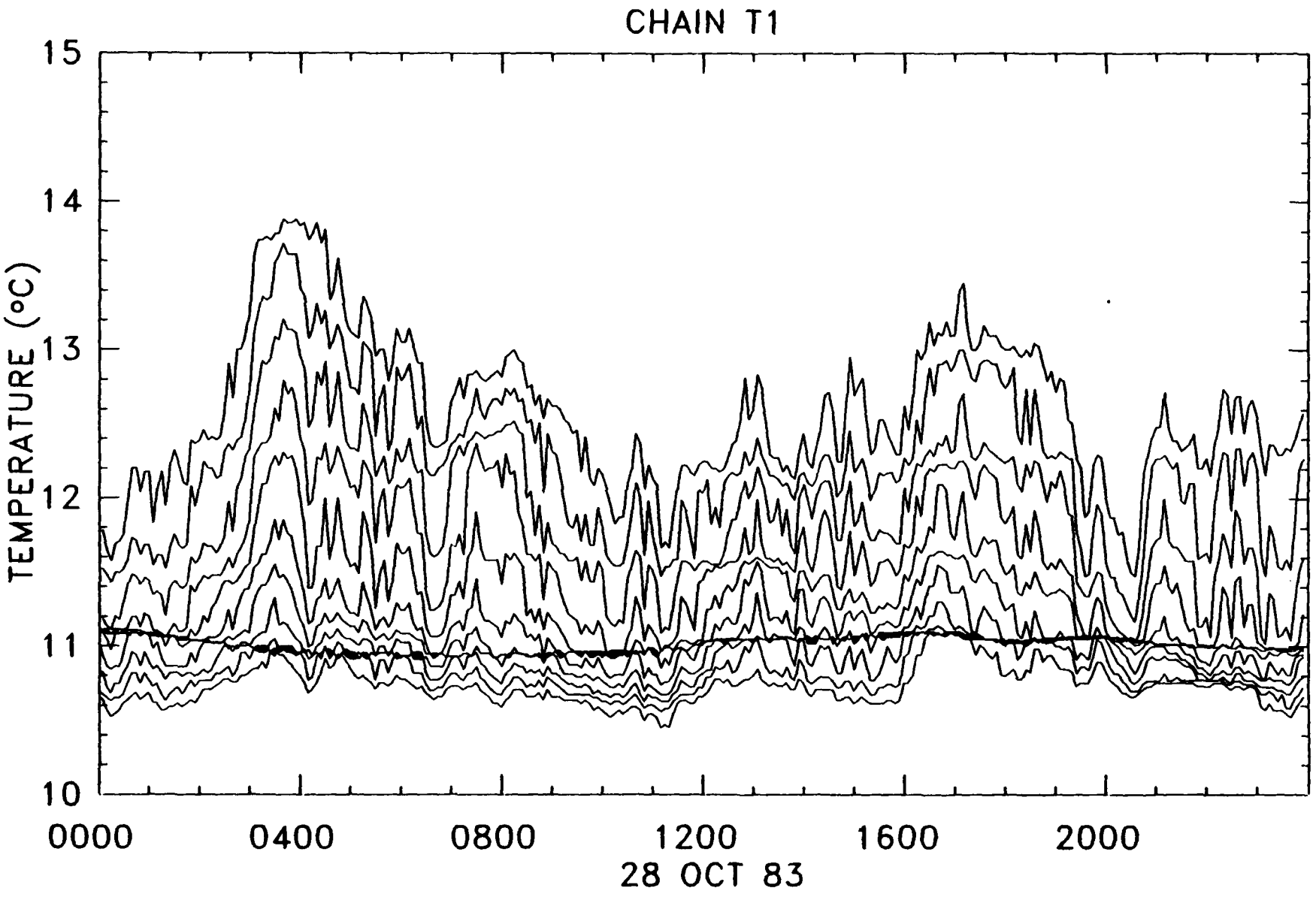
1200
1600
2000
27 OCT 83
16


CHAIN T1
TEMPERATURE (°C)
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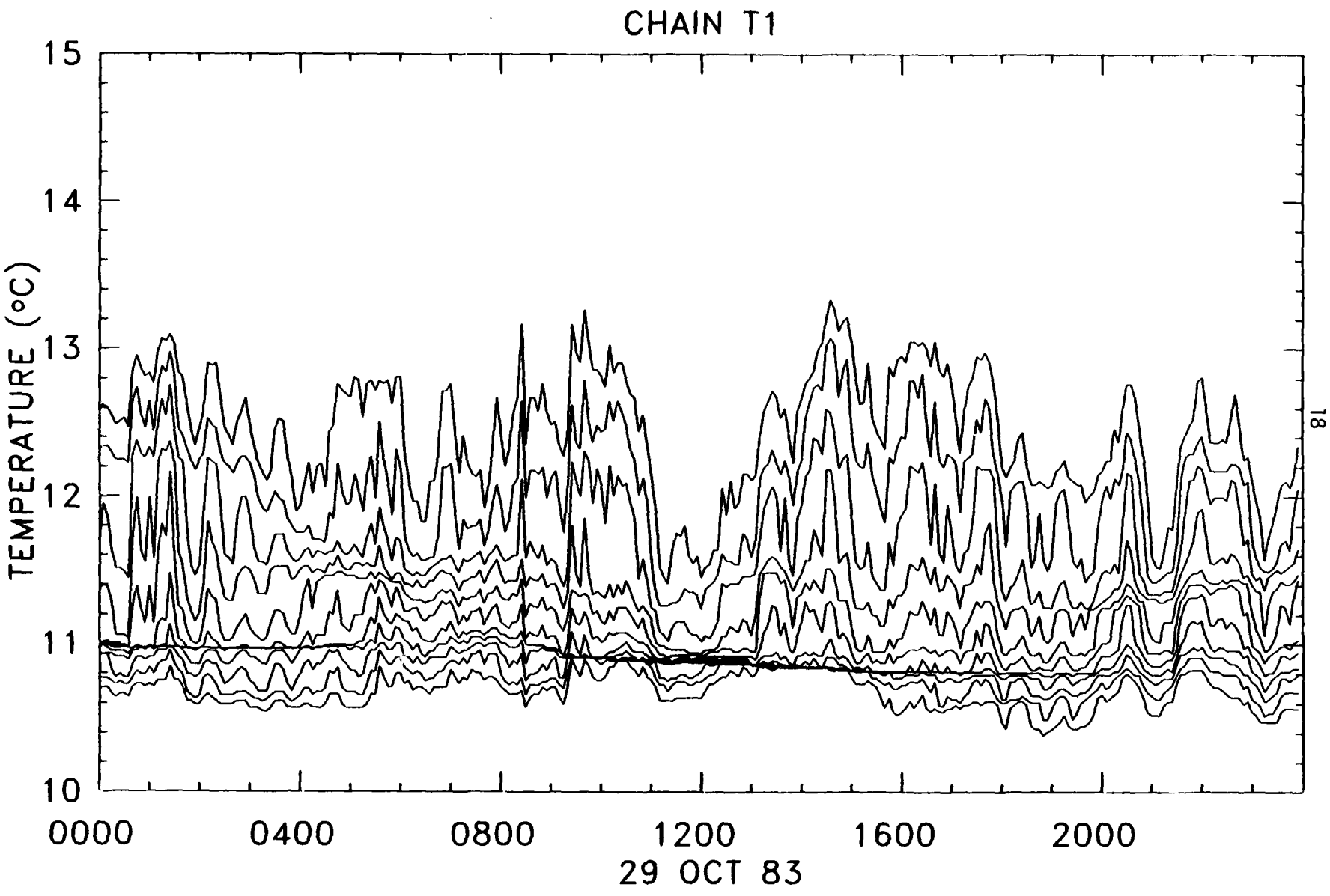
28 OCT 83


CHAIN T1
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TEMPERATURE (°C)
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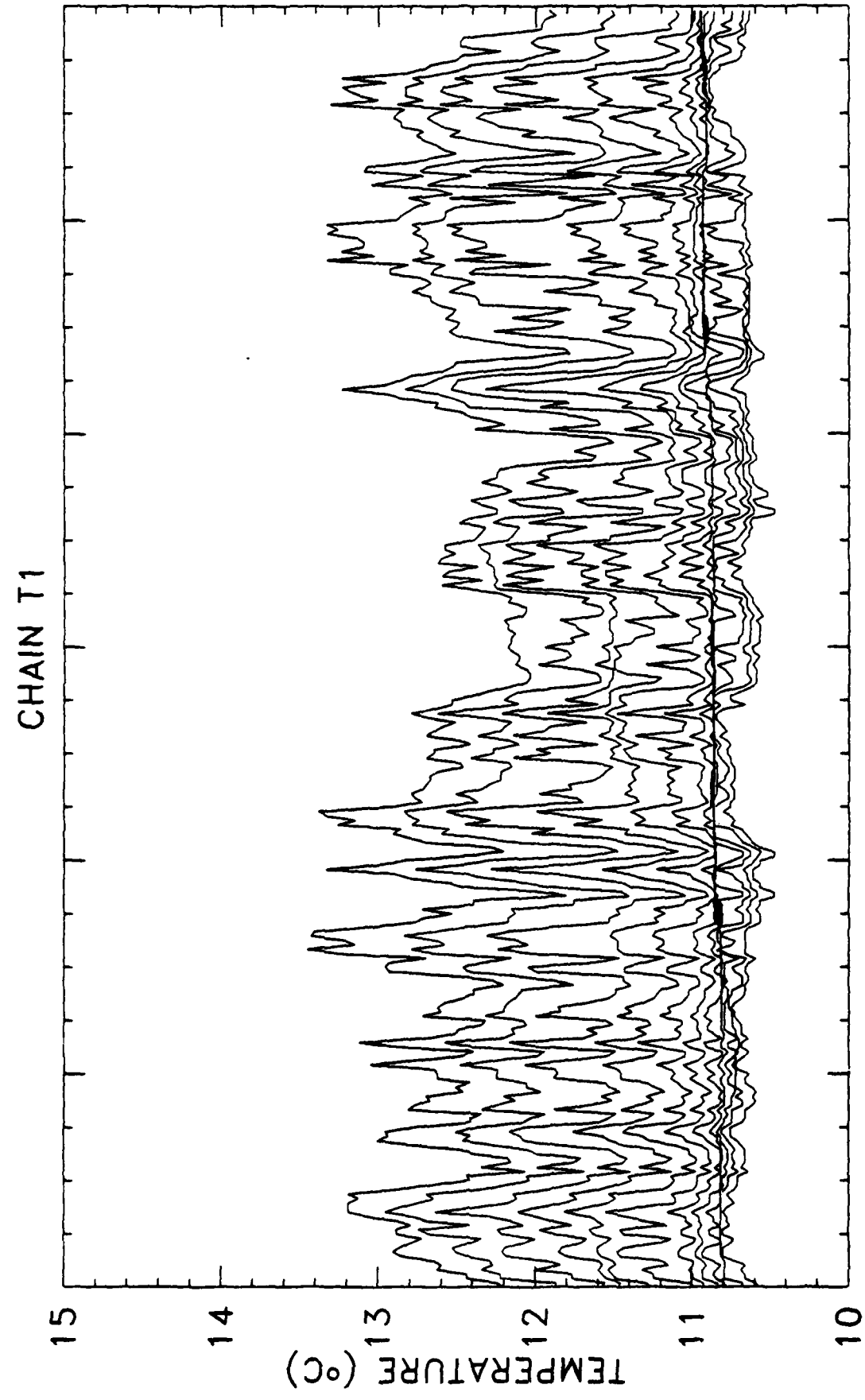
29 OCT 83
18


CHAIN T1
TEMPERATURE (°C)
15
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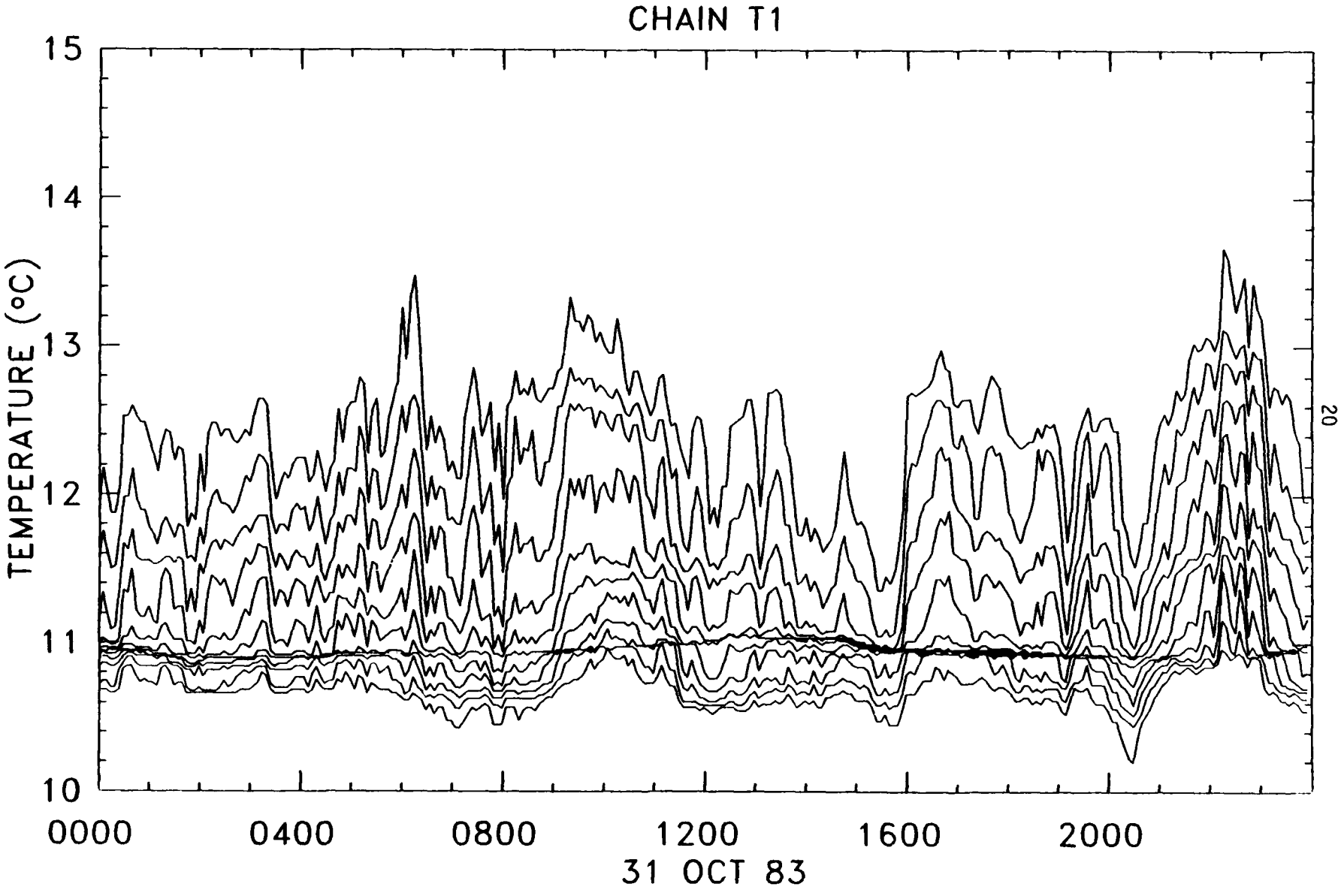
30 OCT 83


CHAIN T1
TEMPERATURE (°C)
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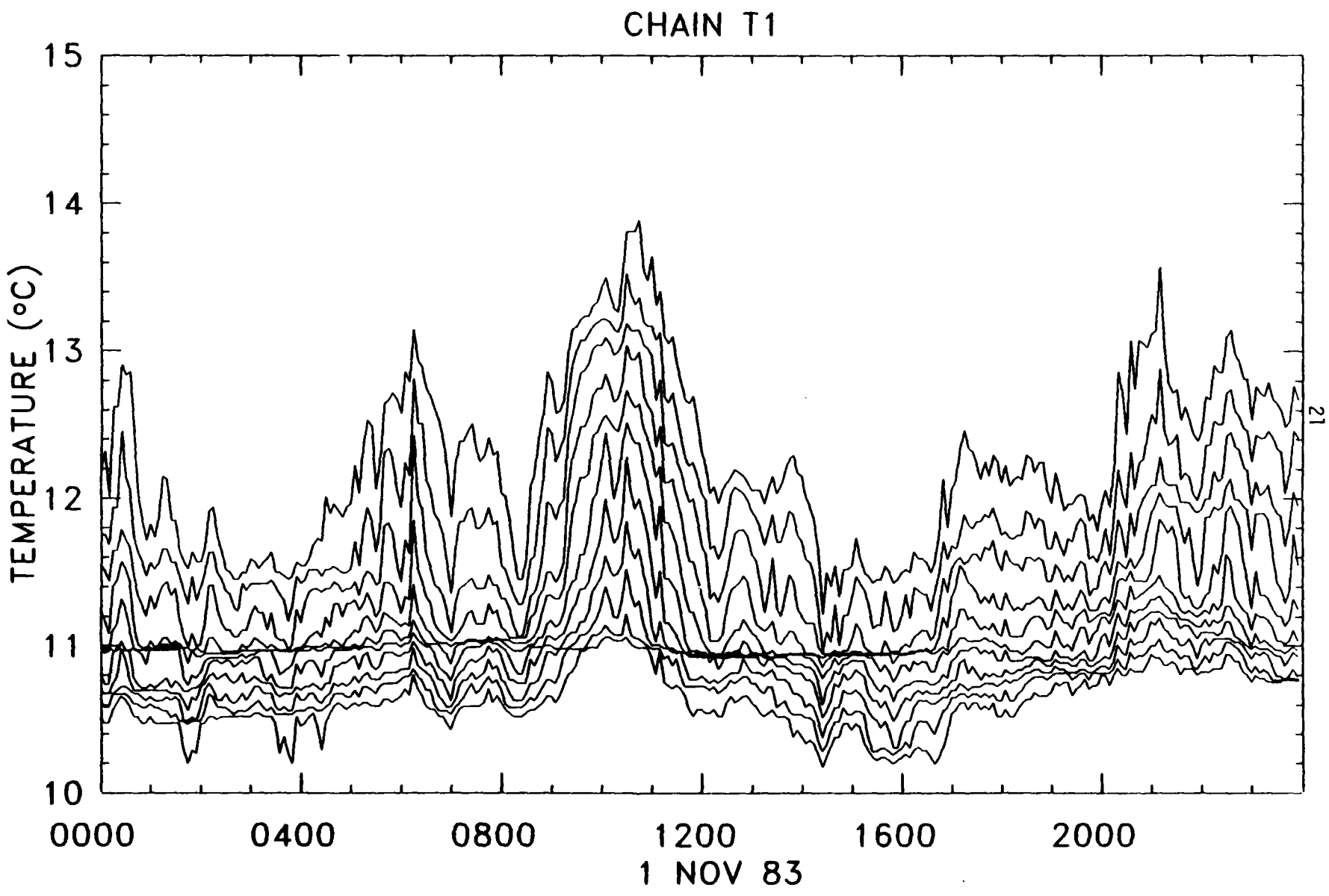
31 OCT 83
20


CHAIN T1
TEMPERATURE (°C)
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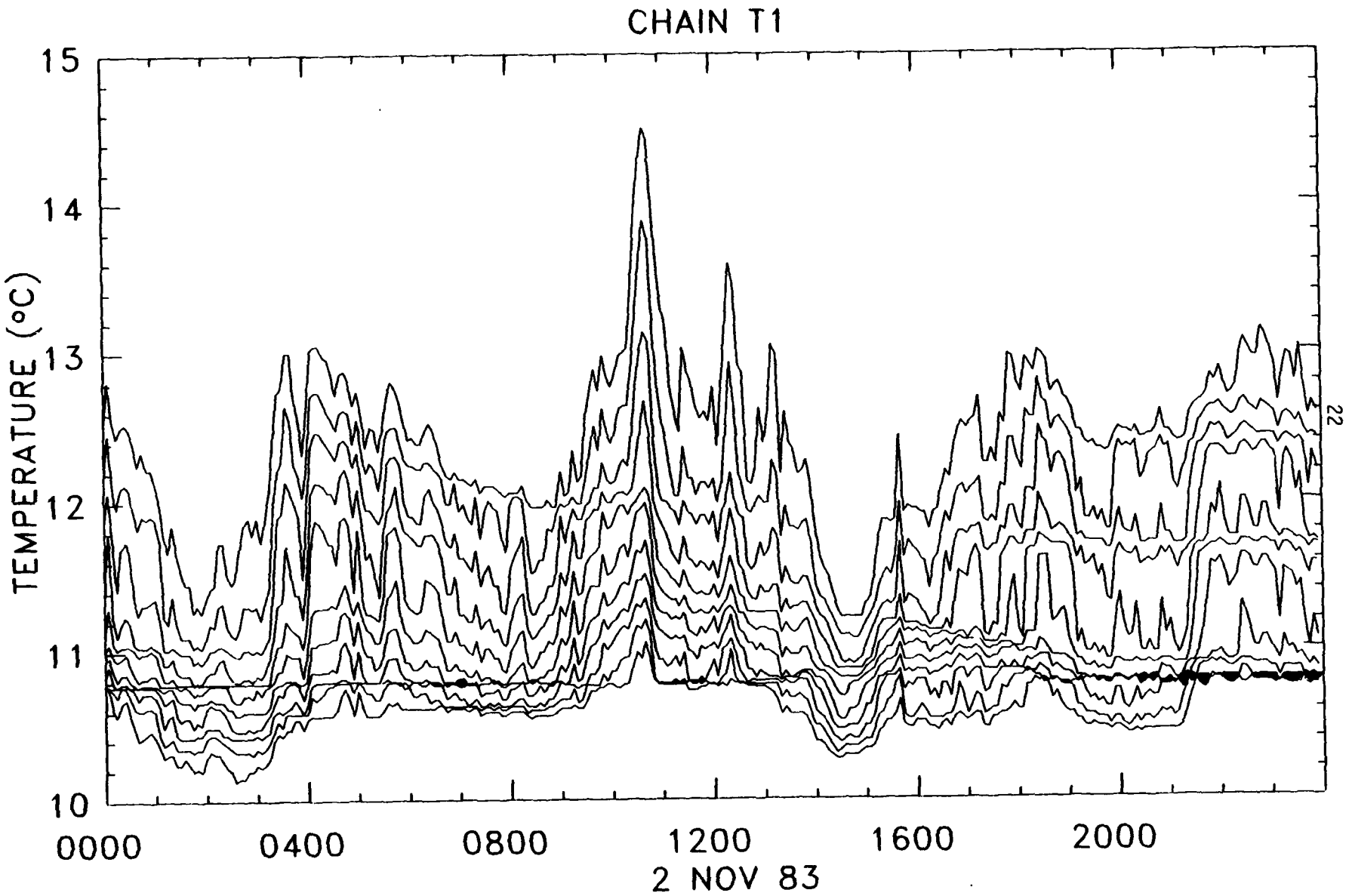
2000
1 NOV 83
21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TEMPERATURE (°C)
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1200
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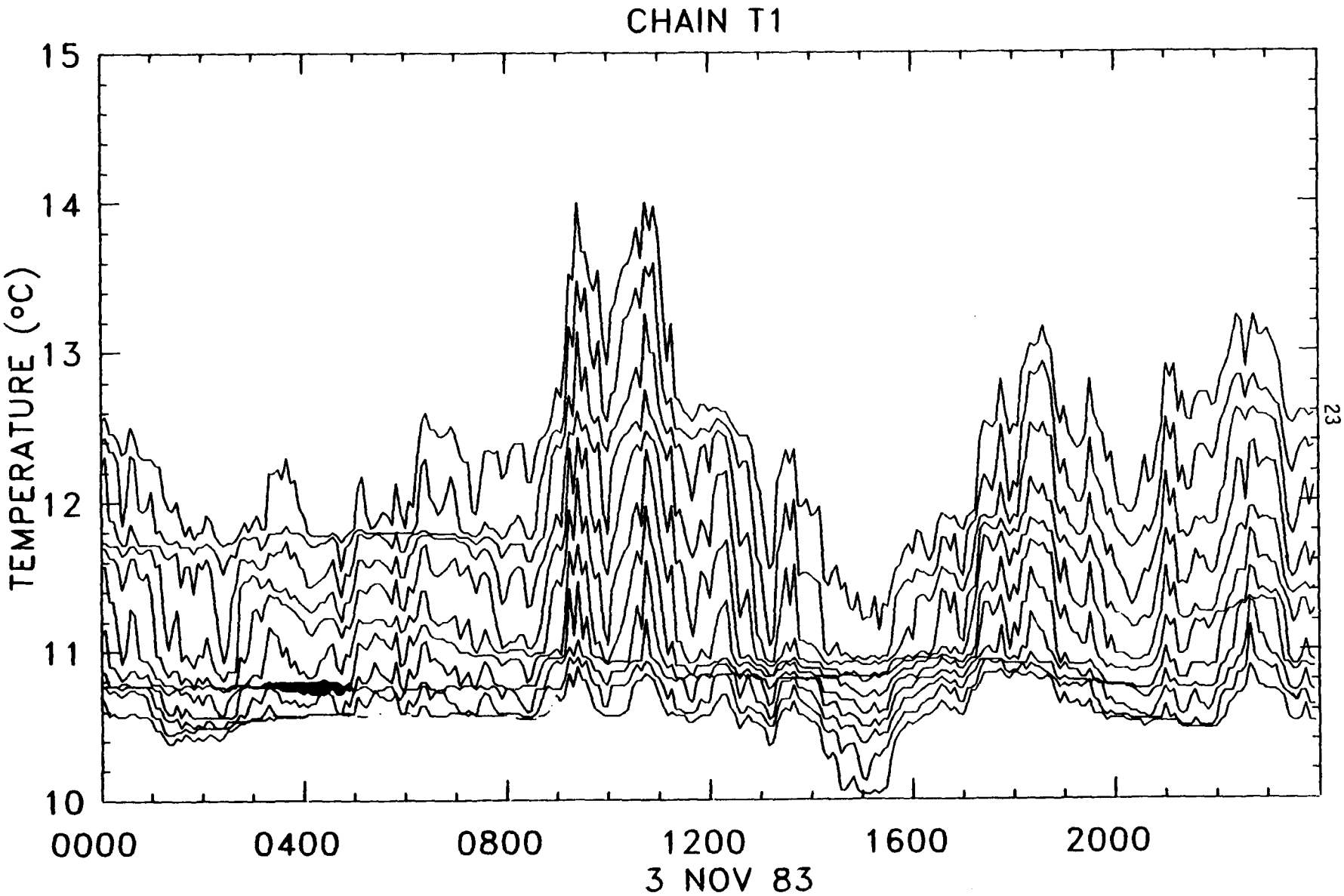
2000
2 NOV 83
22


CHAIN T1
TEMPERATURE (°C)
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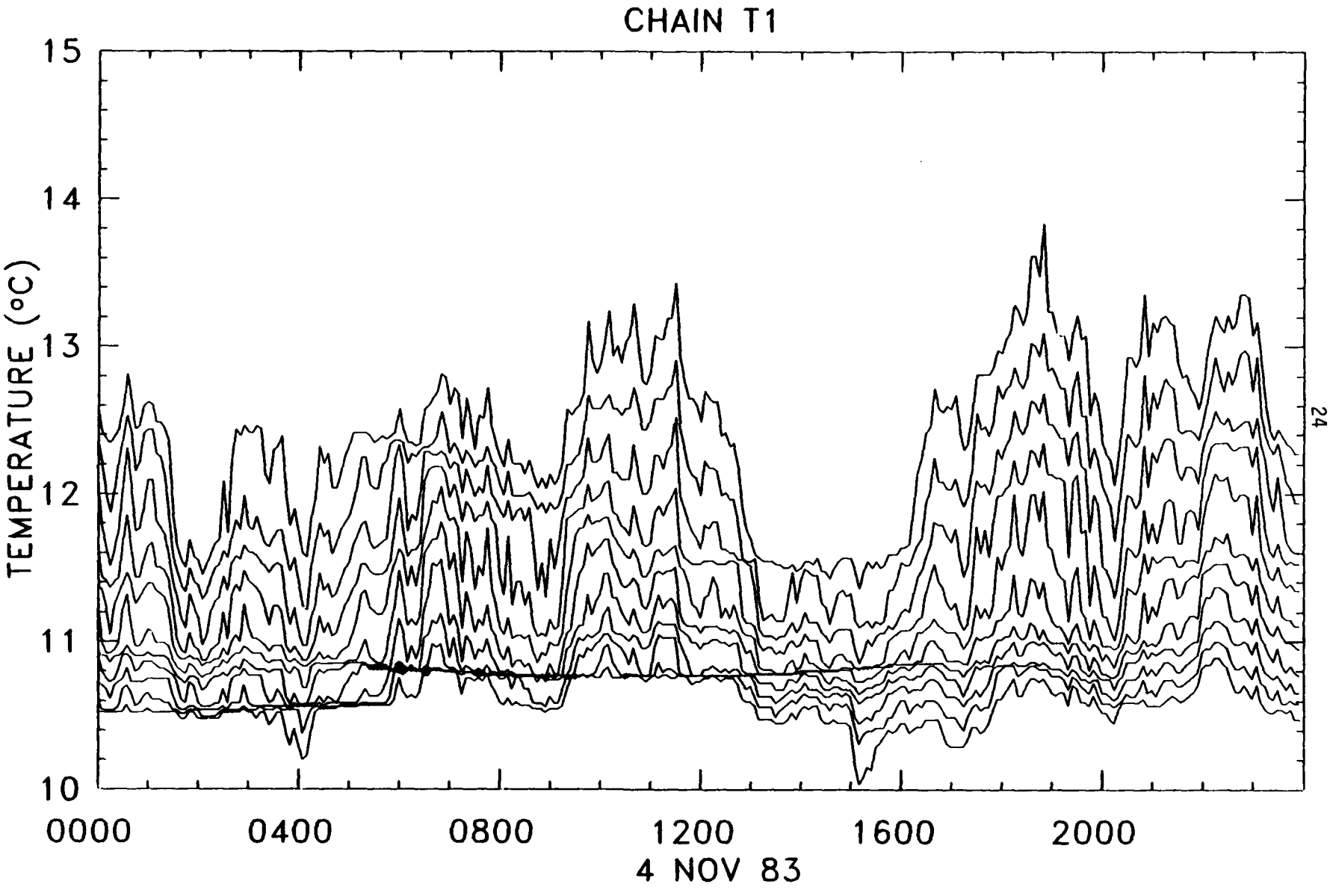
3 NOV 83
23


CHAIN T1
TEMPERATURE (°C)
15
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1200
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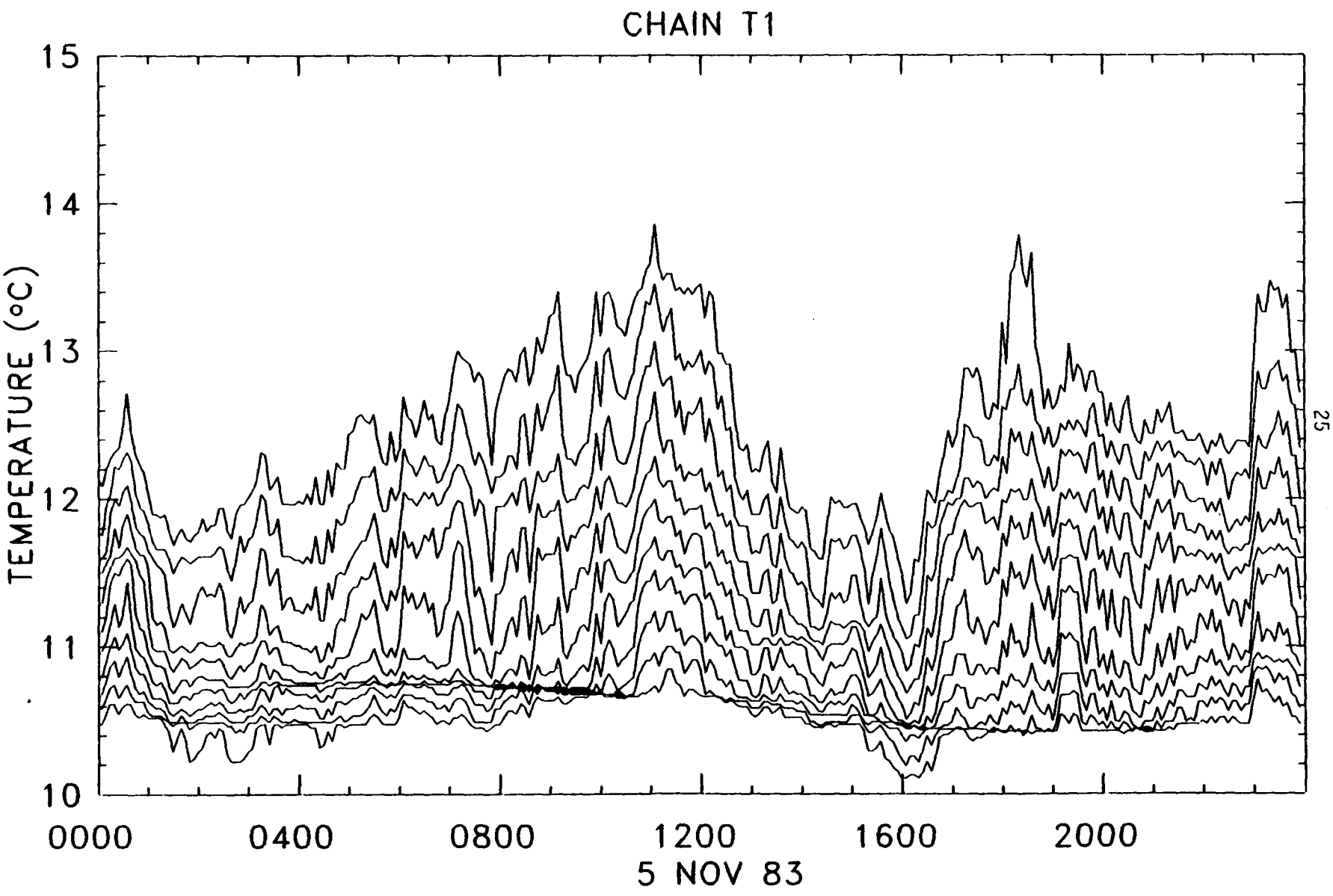
4 NOV 83
24


CHAIN T1
TEMPERATURE (°C)
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14
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1200
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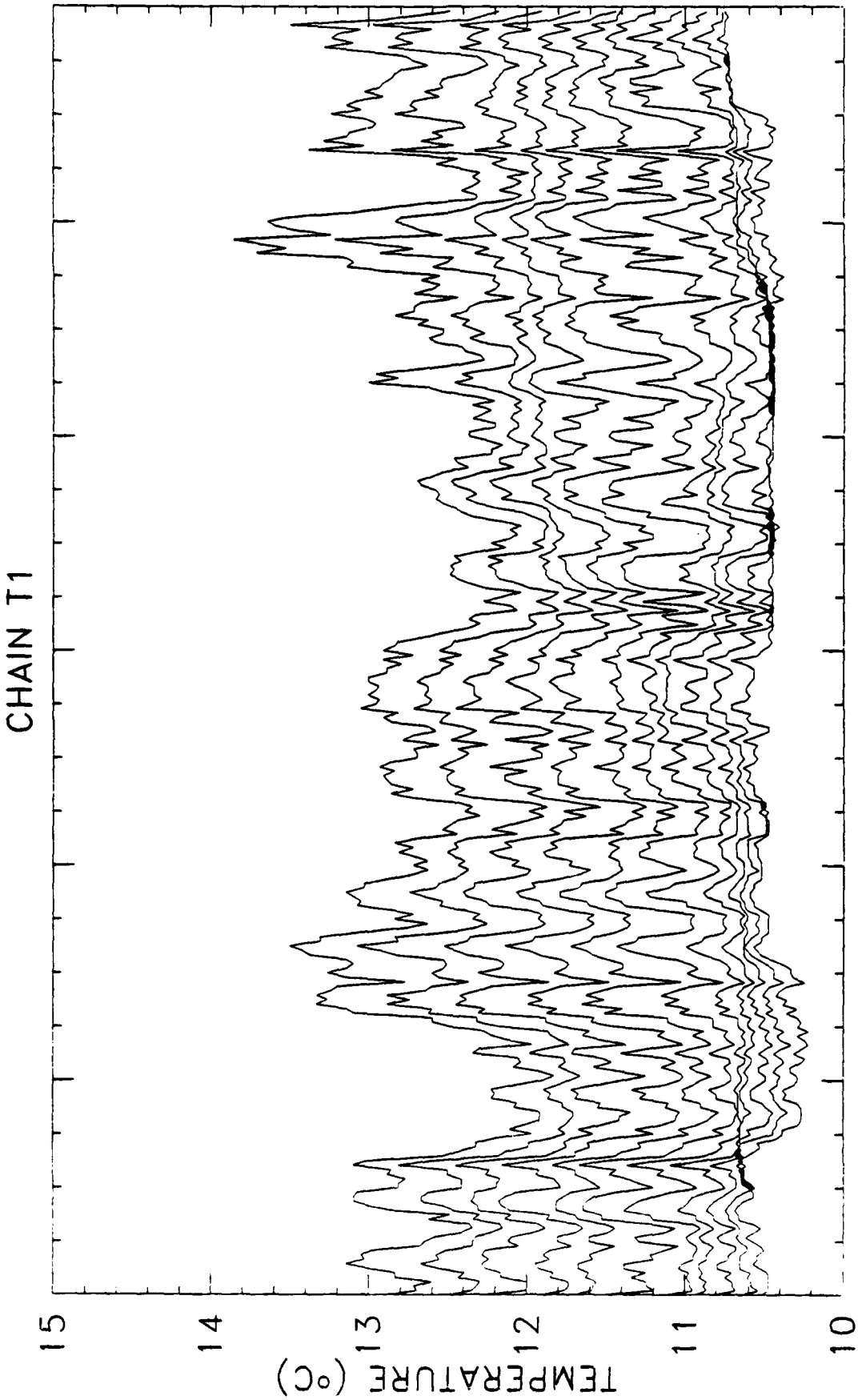
5 NOV 83
25


CHAIN T1
TEMPERATURE (°C)
15
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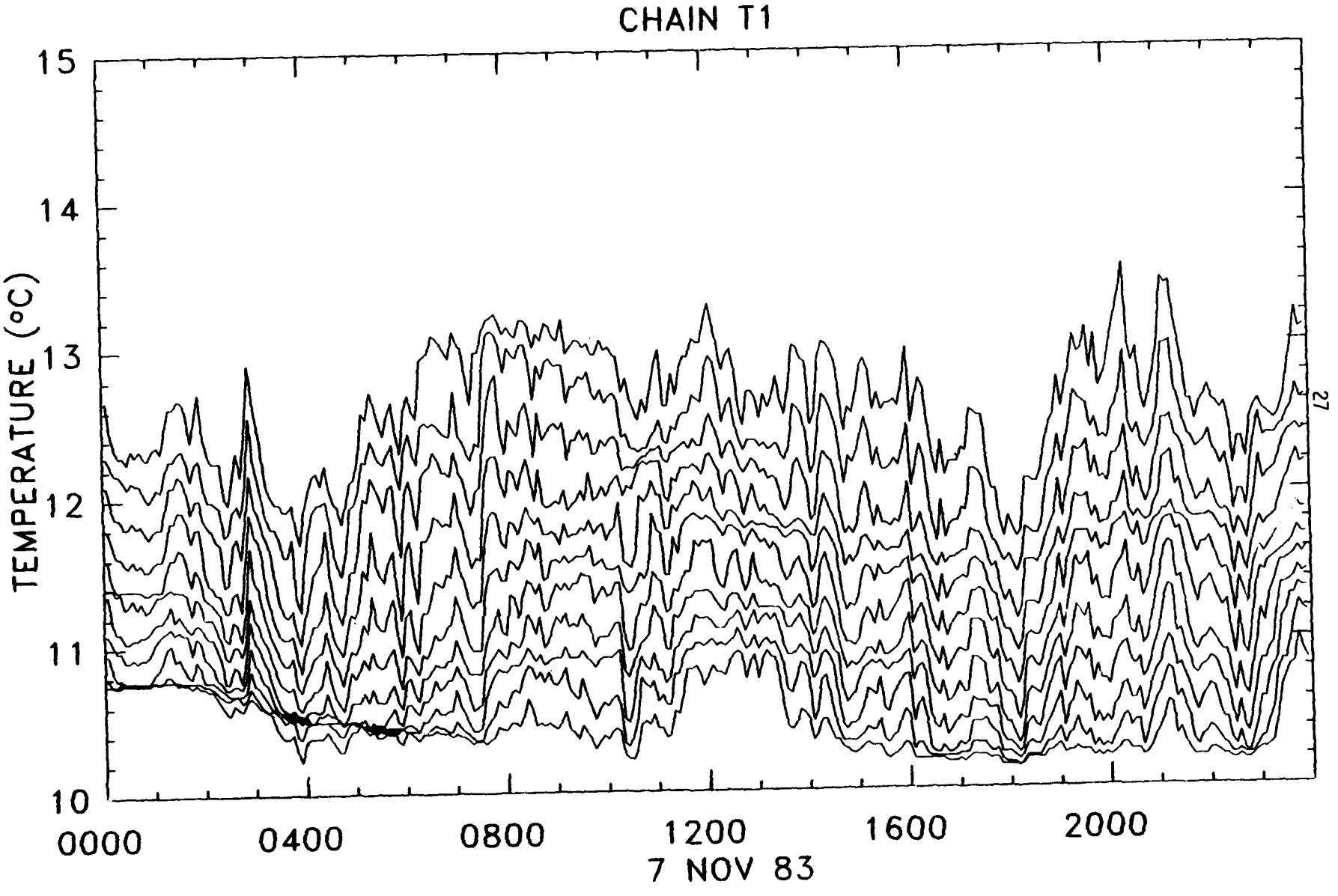
6 NOV 83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TEMPERATURE (°C)
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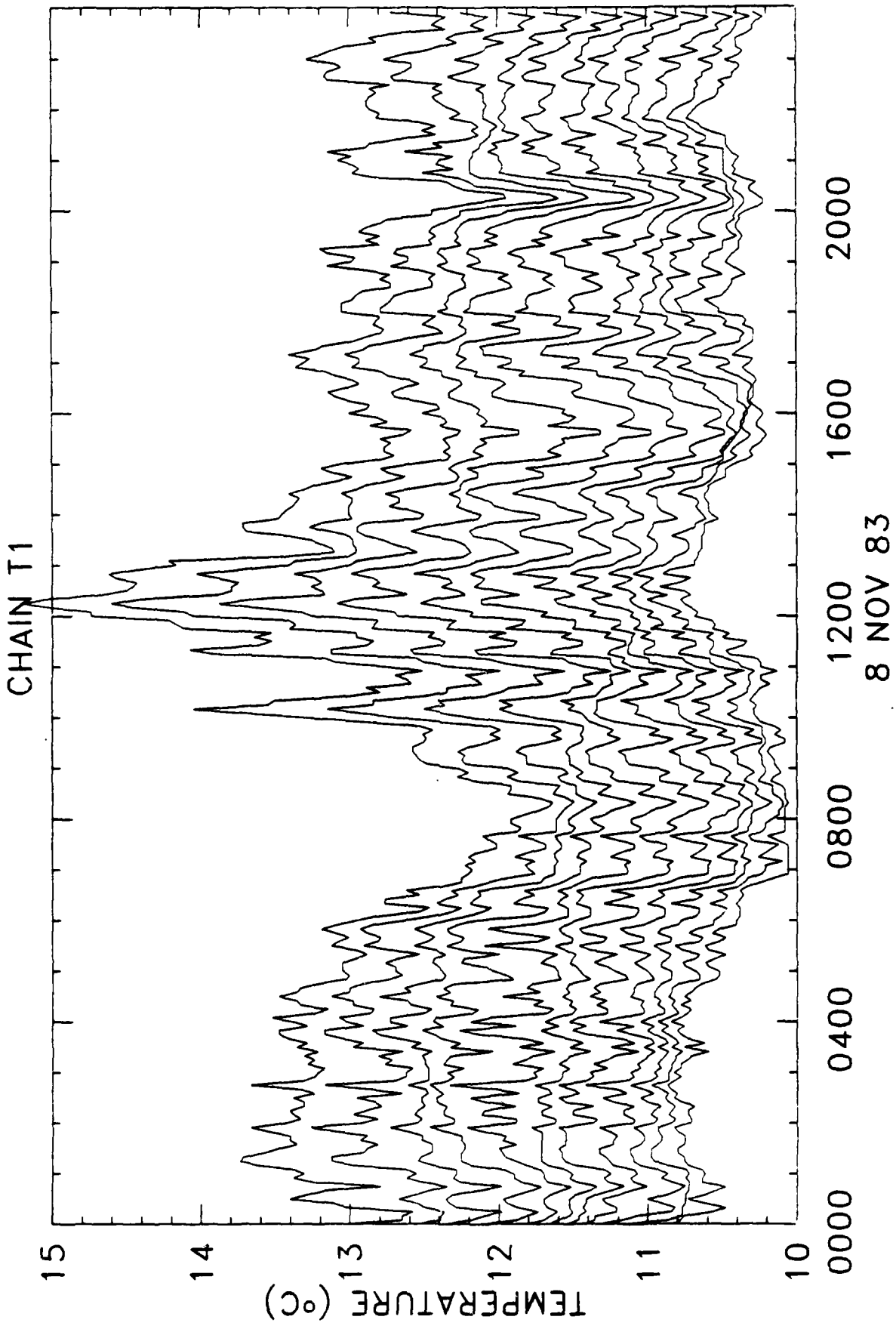
7 NOV 83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TEMPERATURE (°C)
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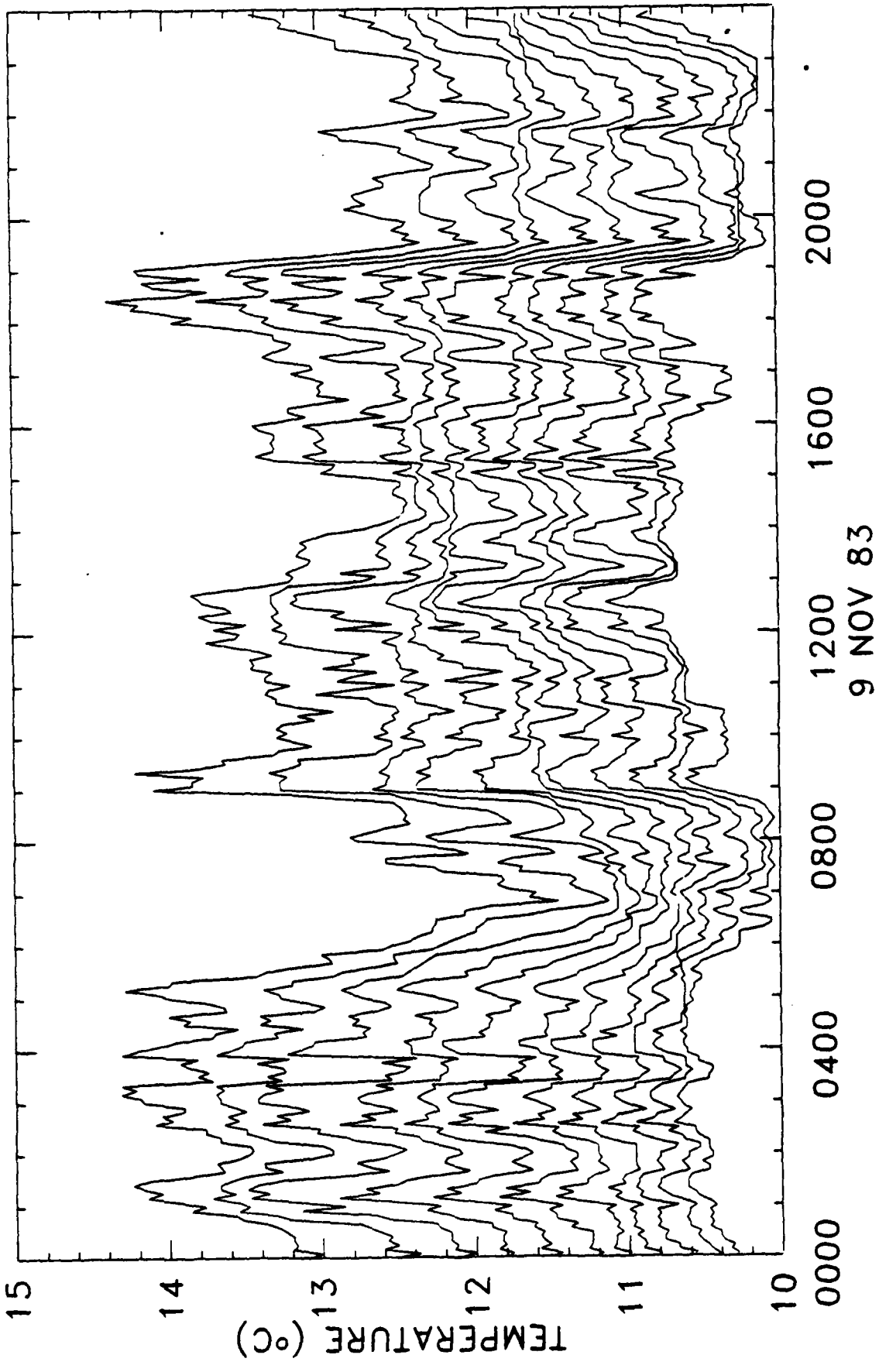
8 NOV 83


CHAIN T1
TEMPERATURE (°C)
15
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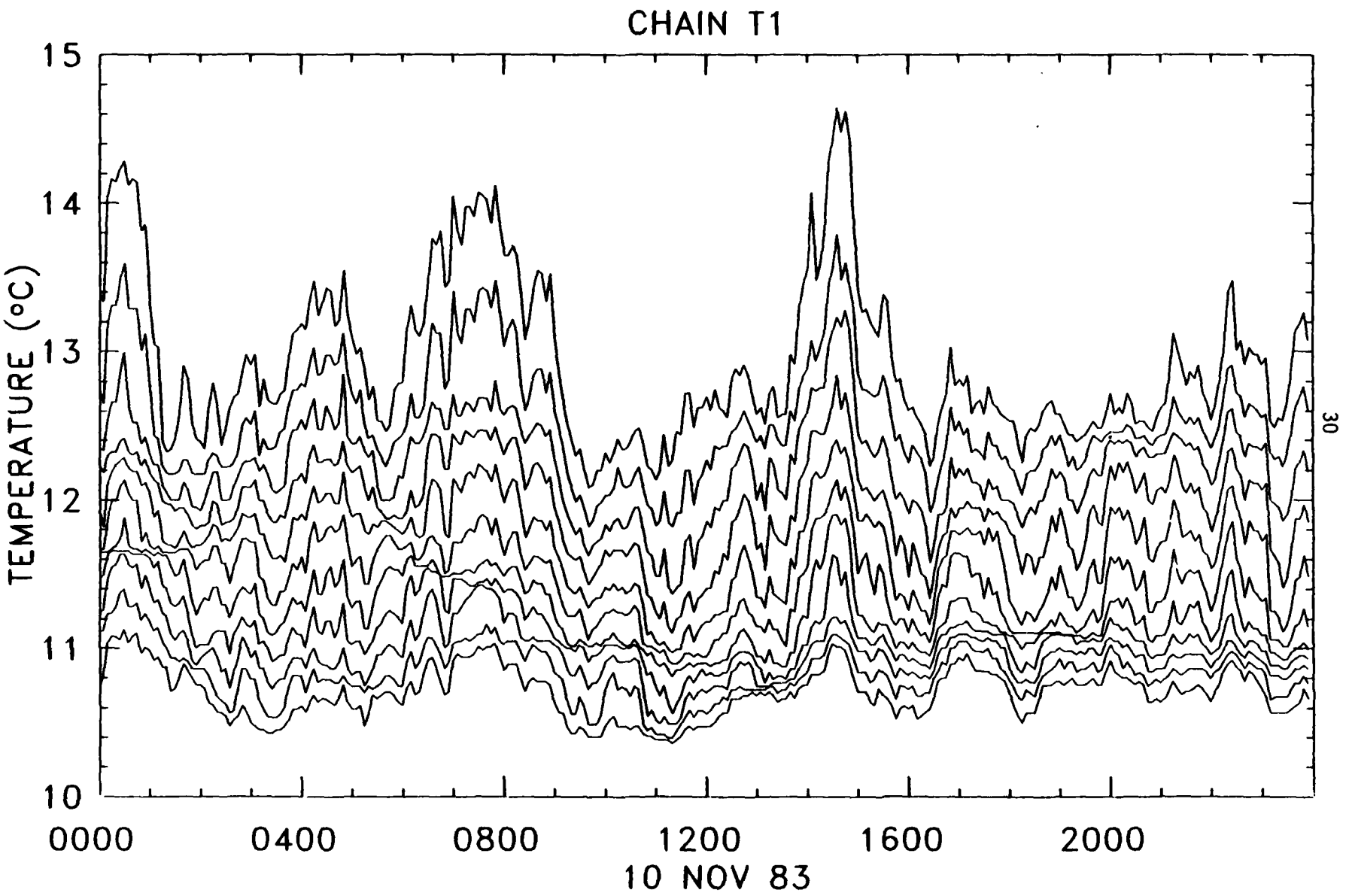
9 NOV 83


CHAIN T1
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TEMPERATURE (°C)
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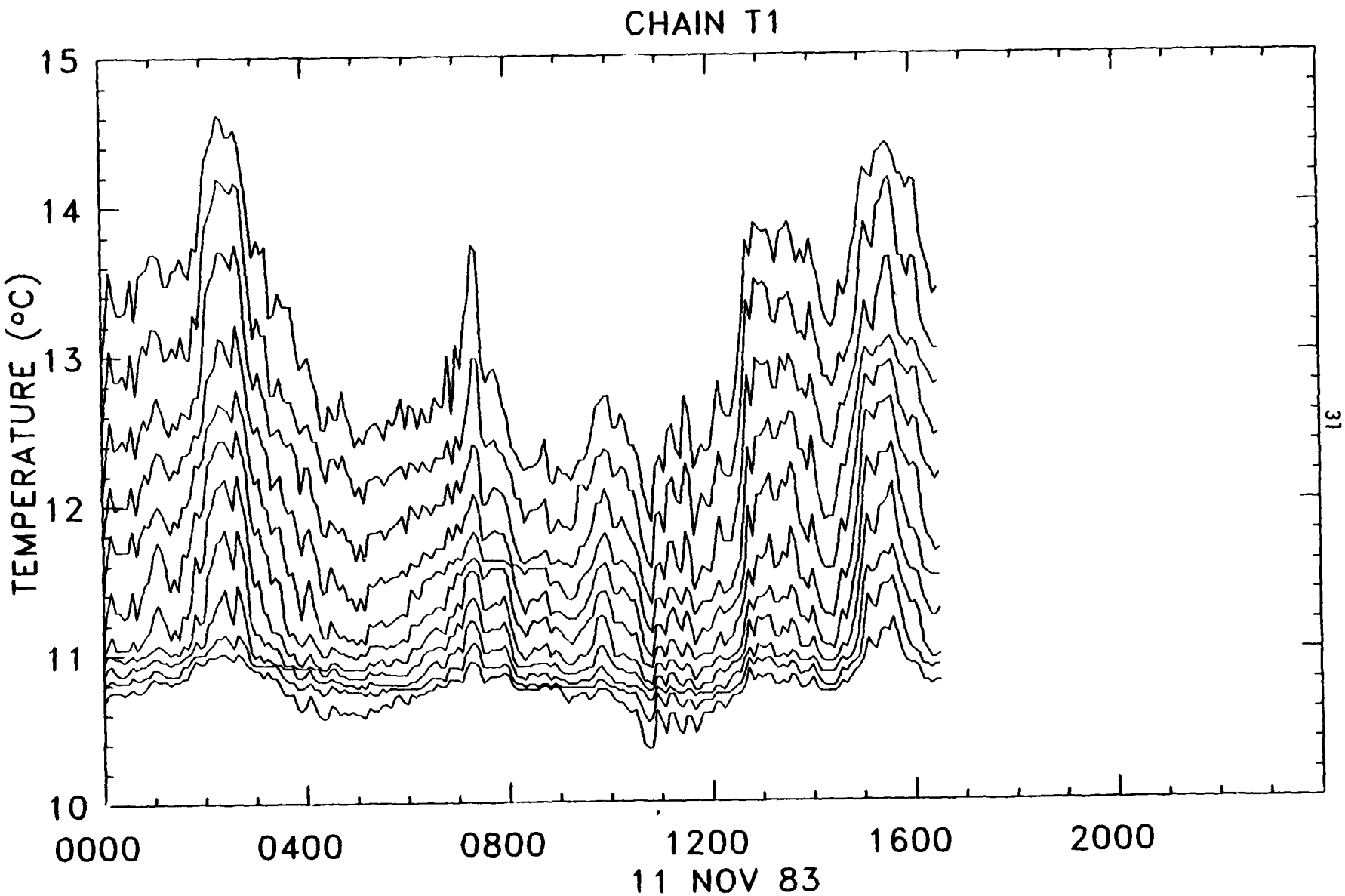
10 NOV 83
30


CHAIN T1
TEMPERATURE (°C)
15
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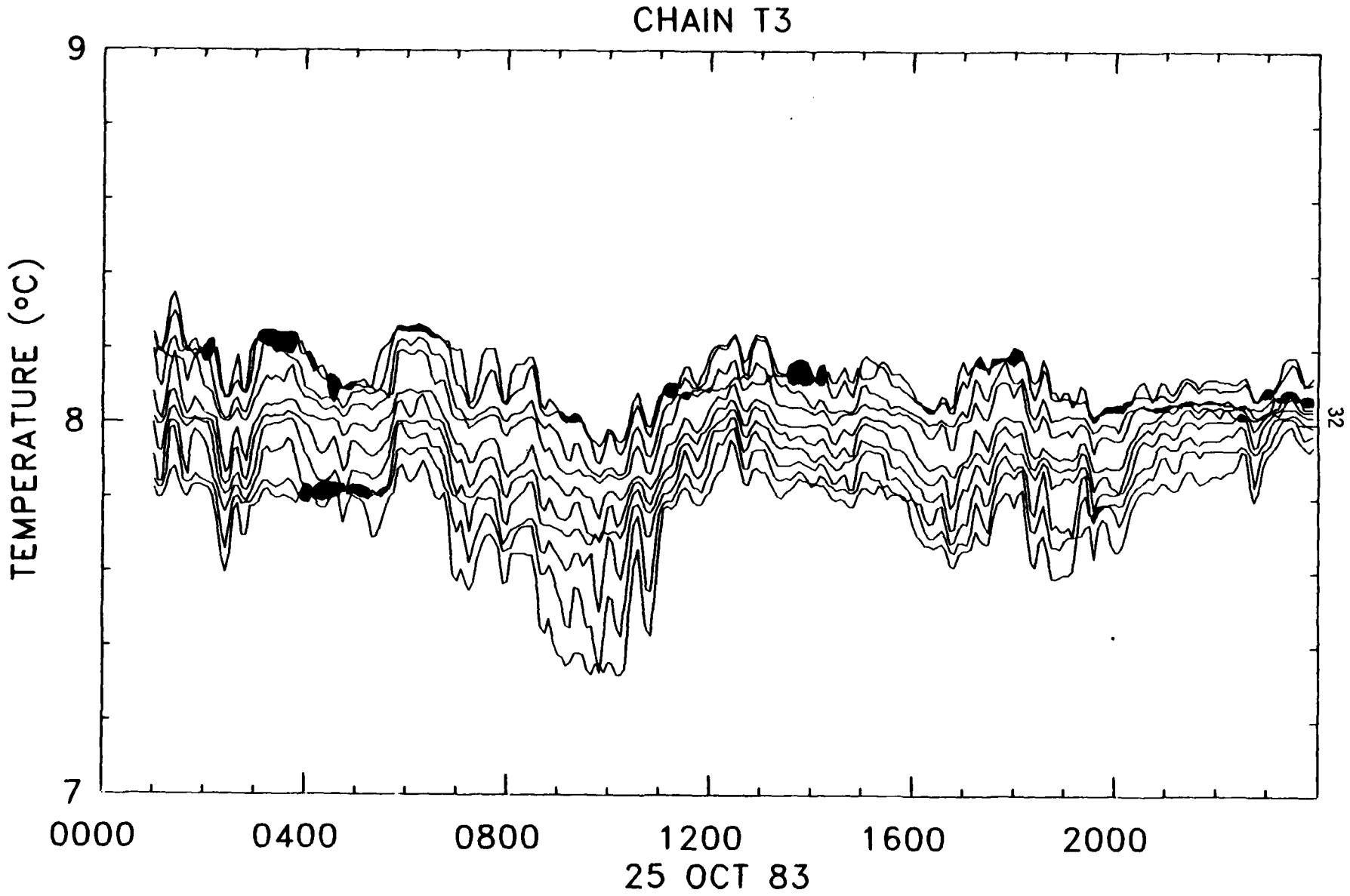
11 NOV 83
31


CHAIN T3
9
8
7
TEMPERATURE (°C)
32
0000
0400
0800
1200
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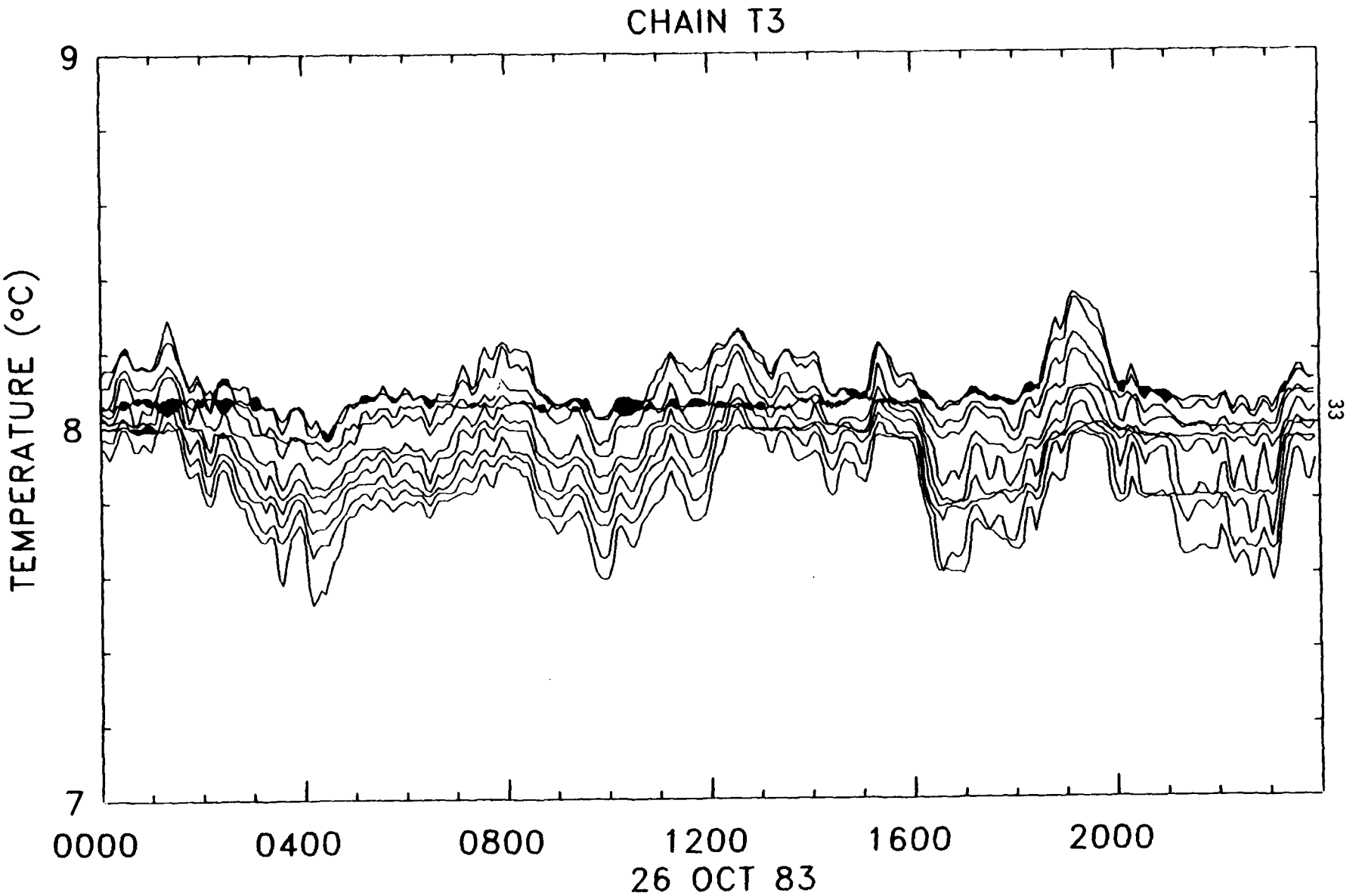
25 OCT 83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8
7
TEMPERATURE (°C)
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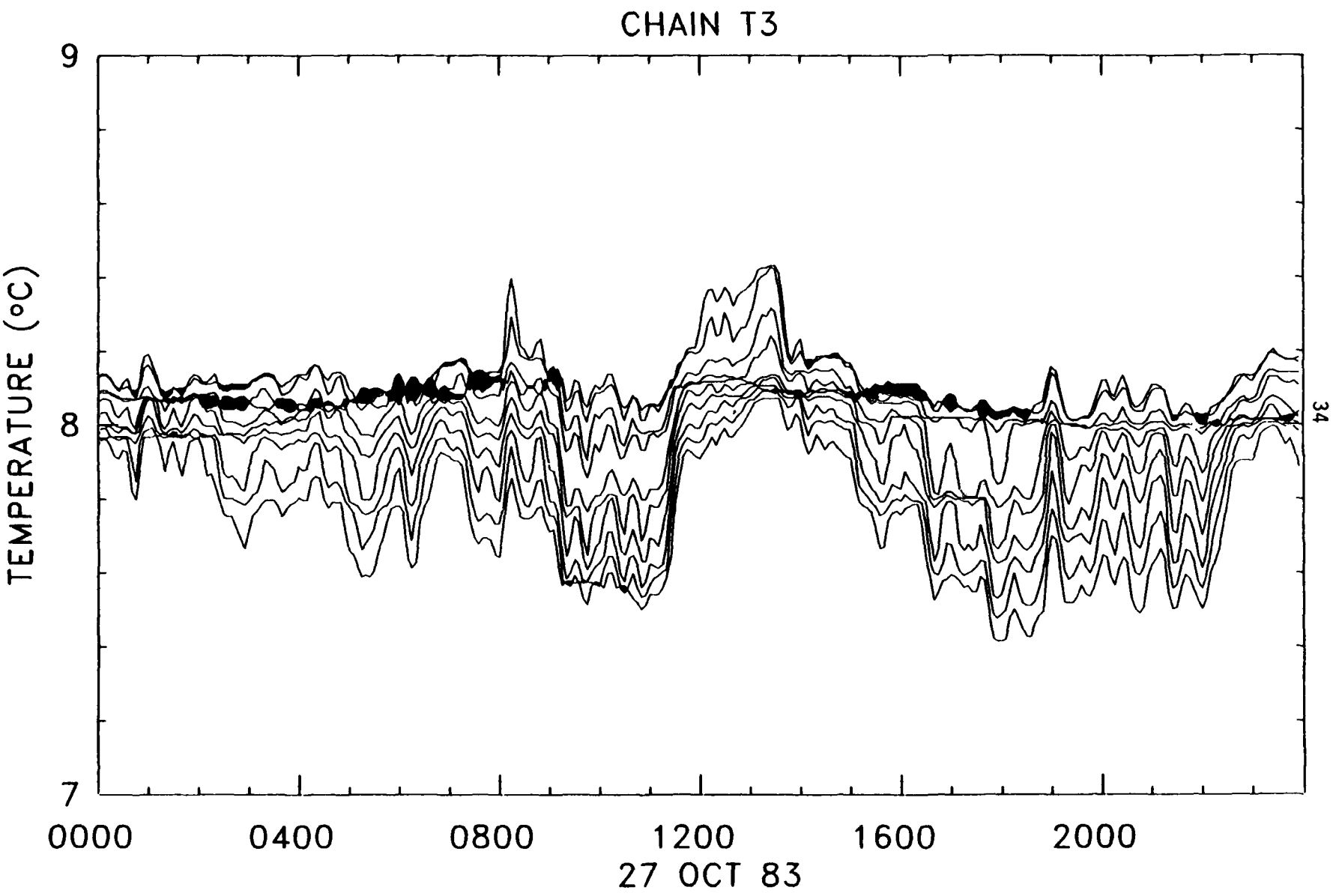
1600
2000
26 OCT 83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8
7
TEMPERATURE (°C)
34
0000
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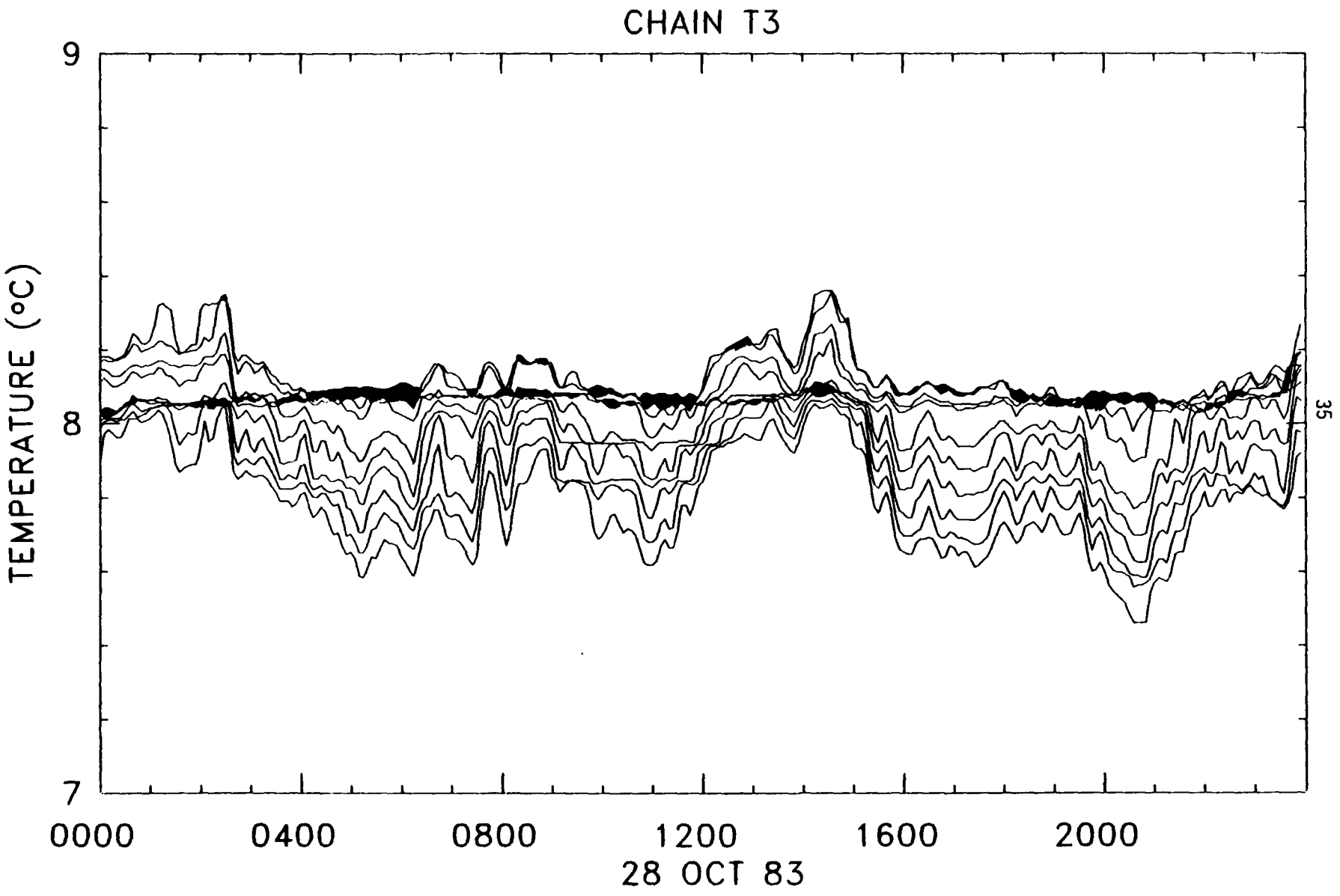
27 OCT 83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7
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35
0000
0400
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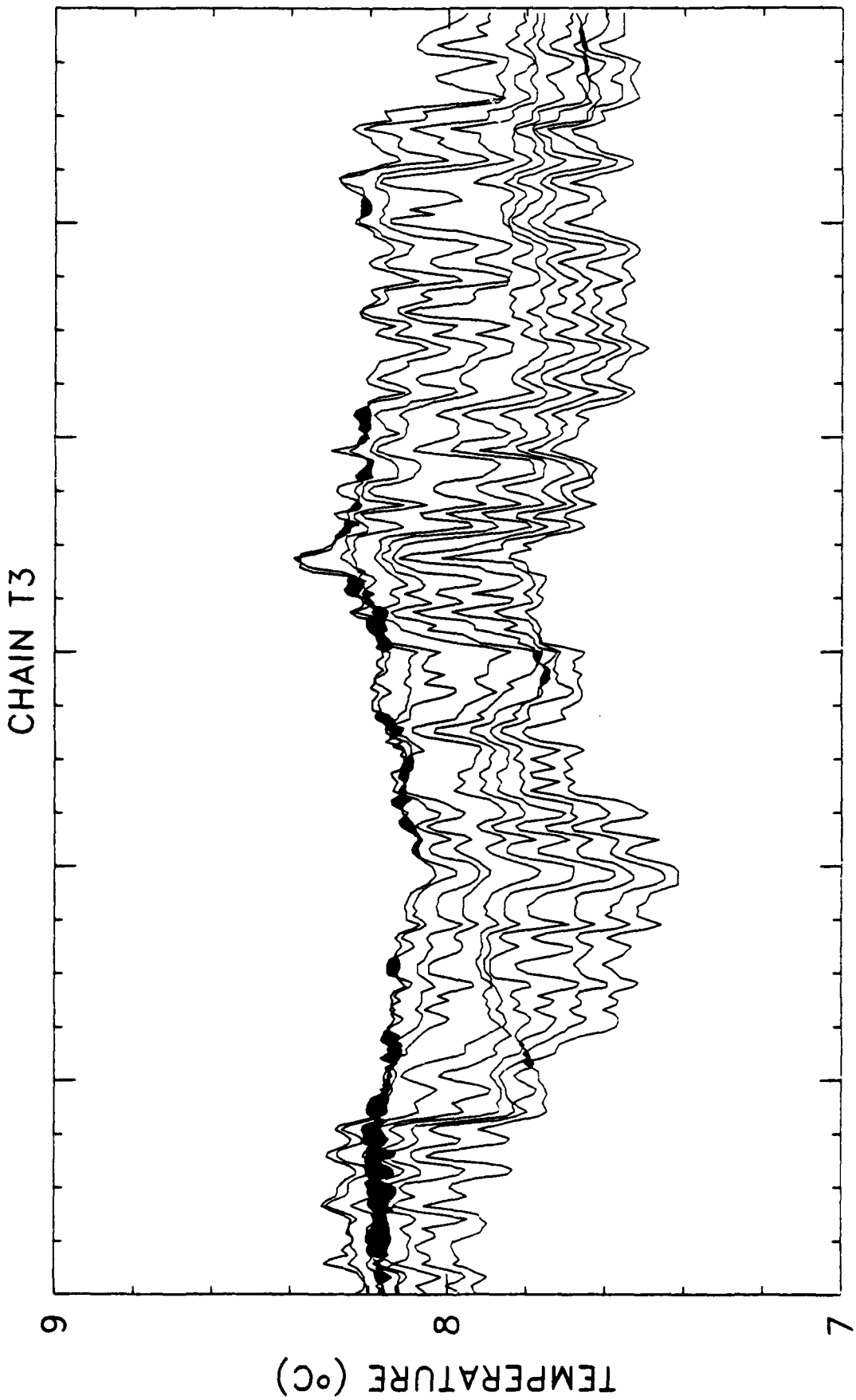
28 OCT 83


CHAIN T3
TEMPERATURE (°C)
9
8
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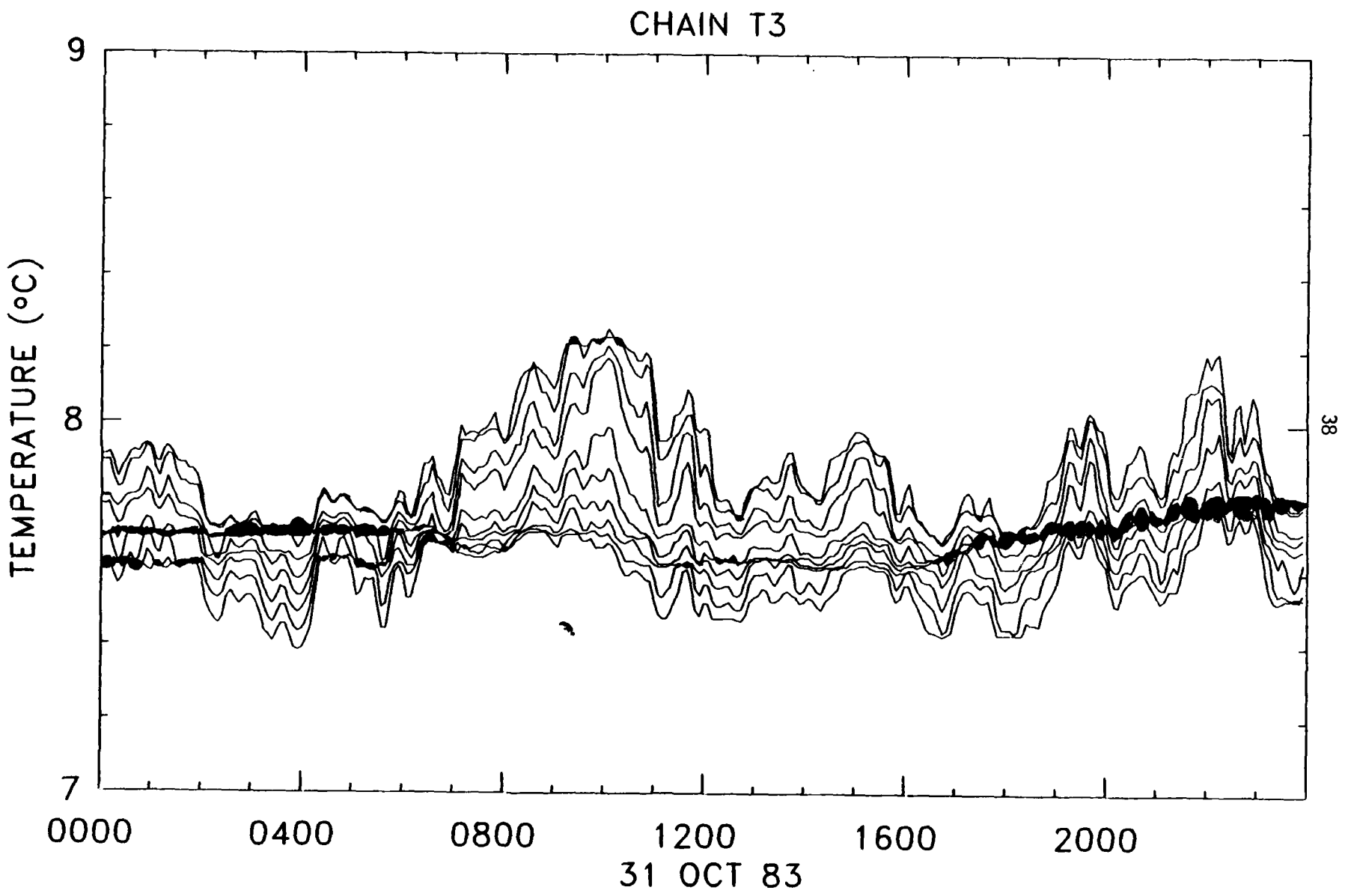
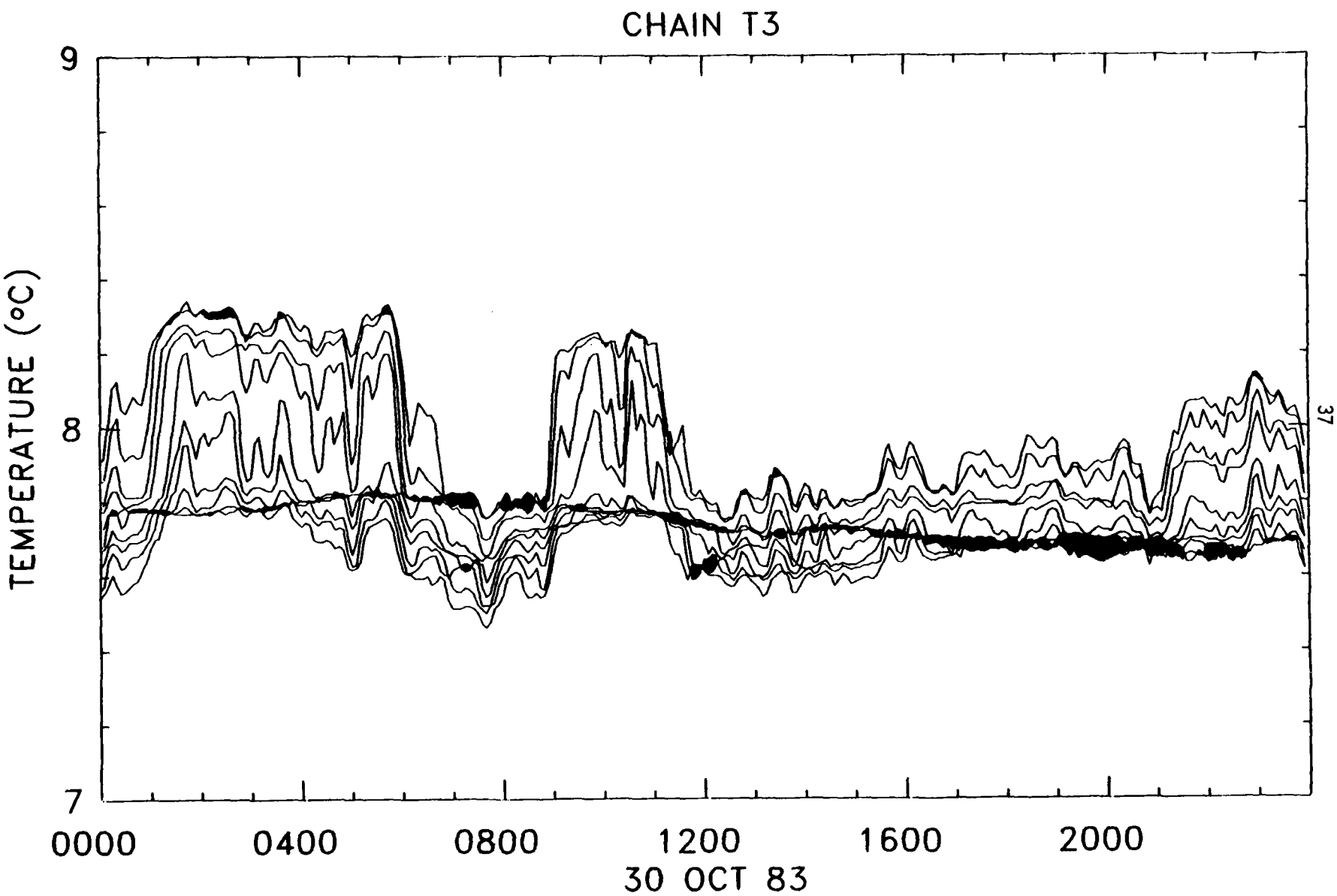
0400
0800
1200
1600
2000
29 OCT 83


CHAIN T3
9
8
7
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
31 OCT 83
38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TEMPERATURE (°C)
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0400
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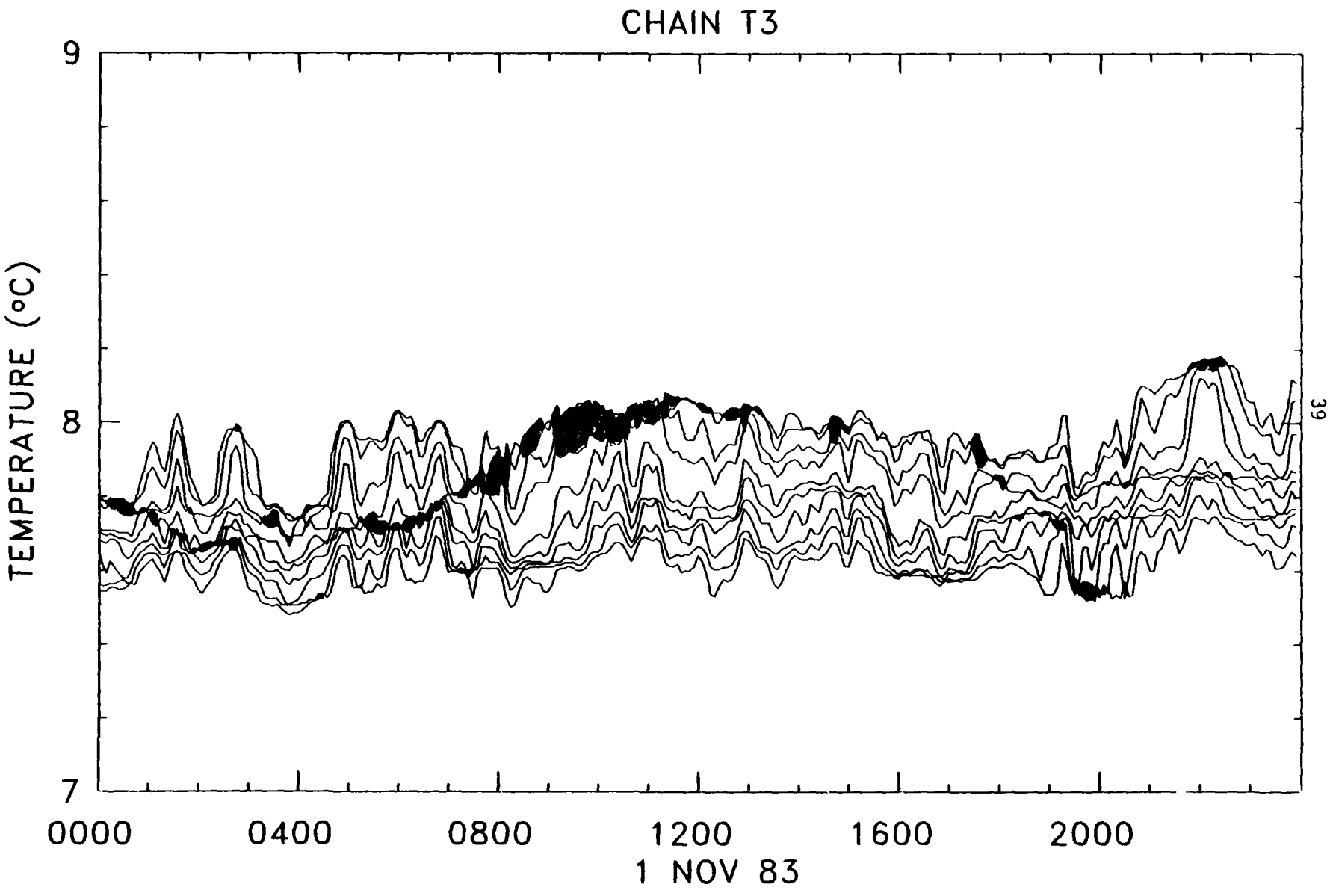
30 OCT 83
37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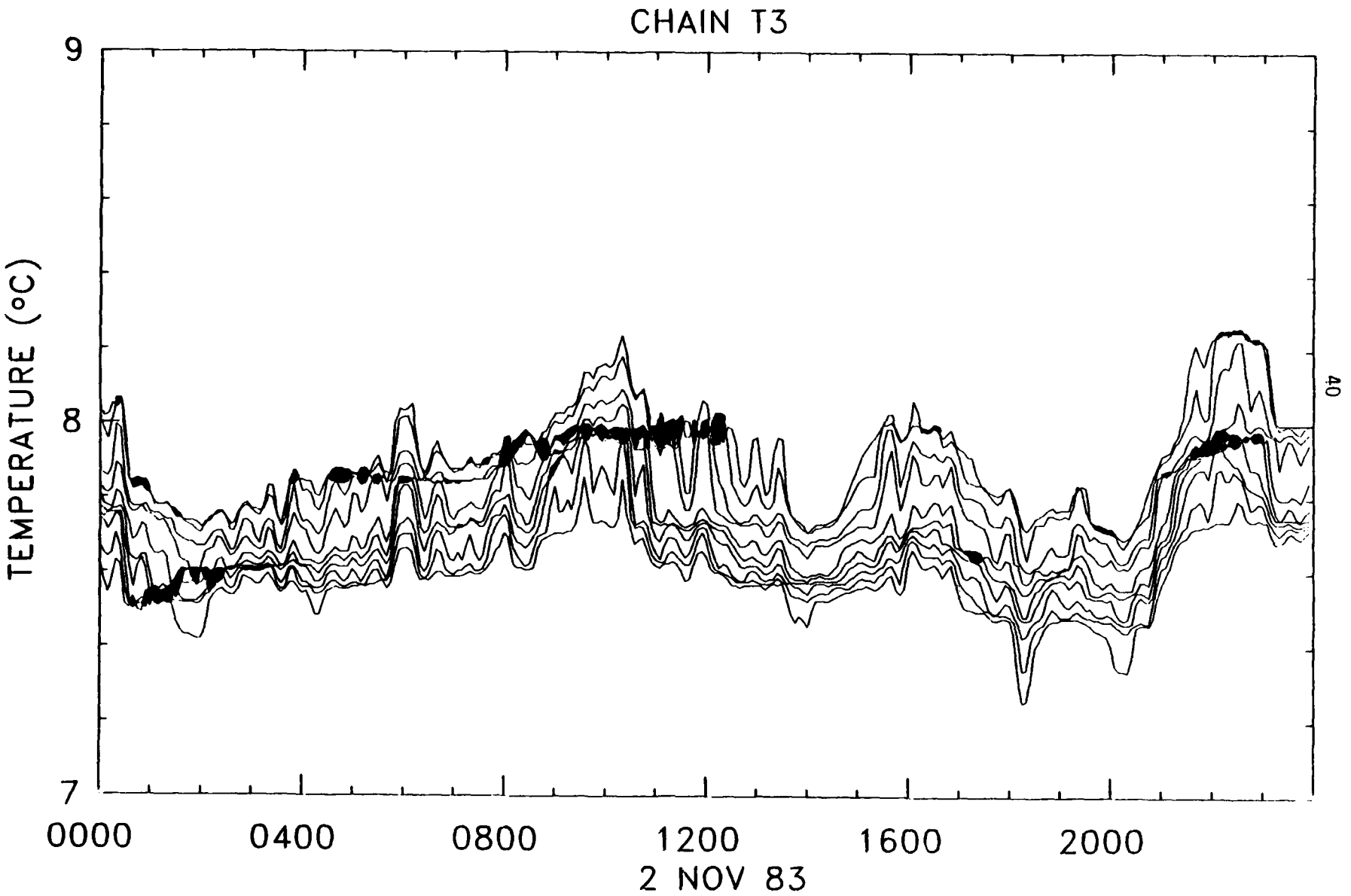
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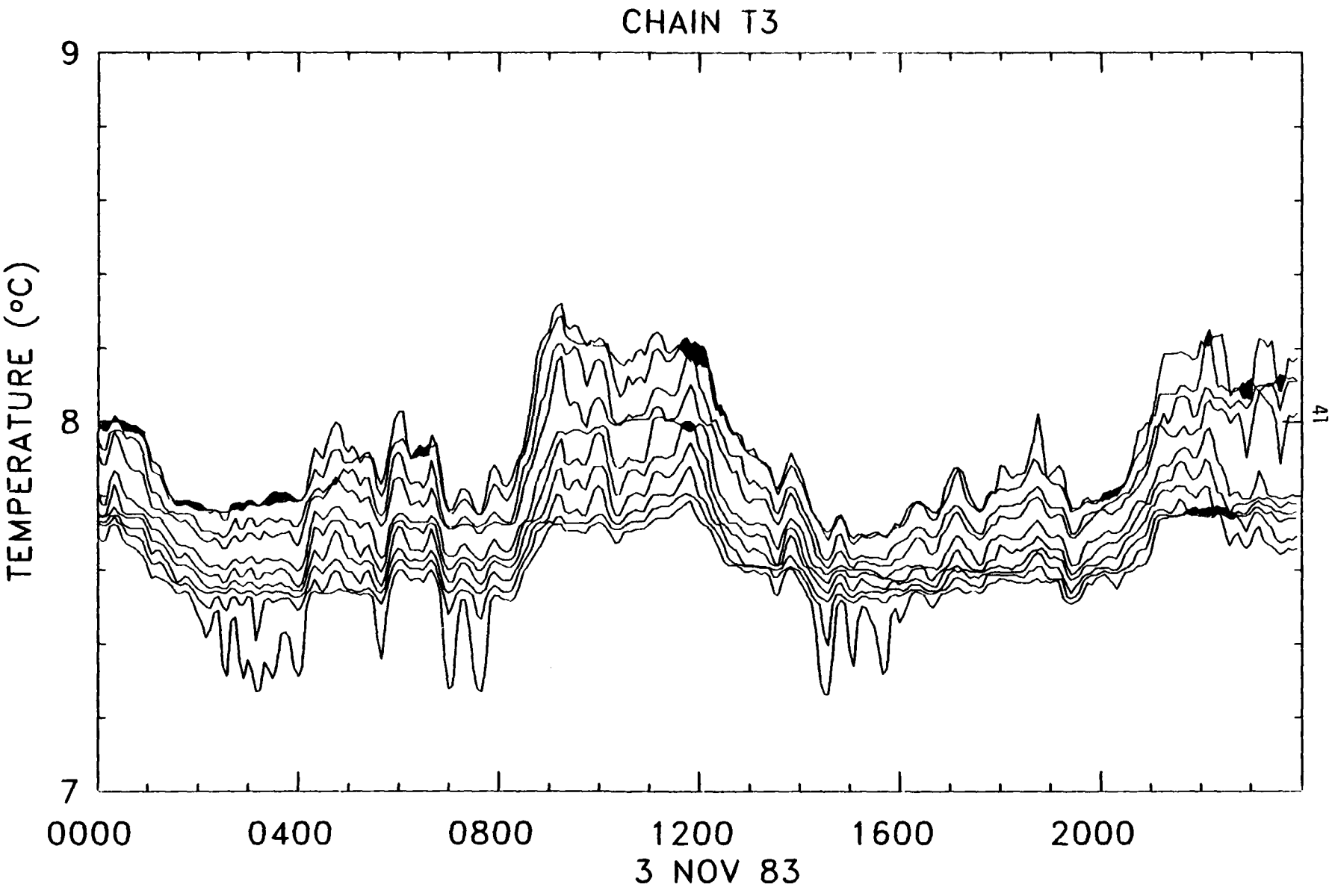
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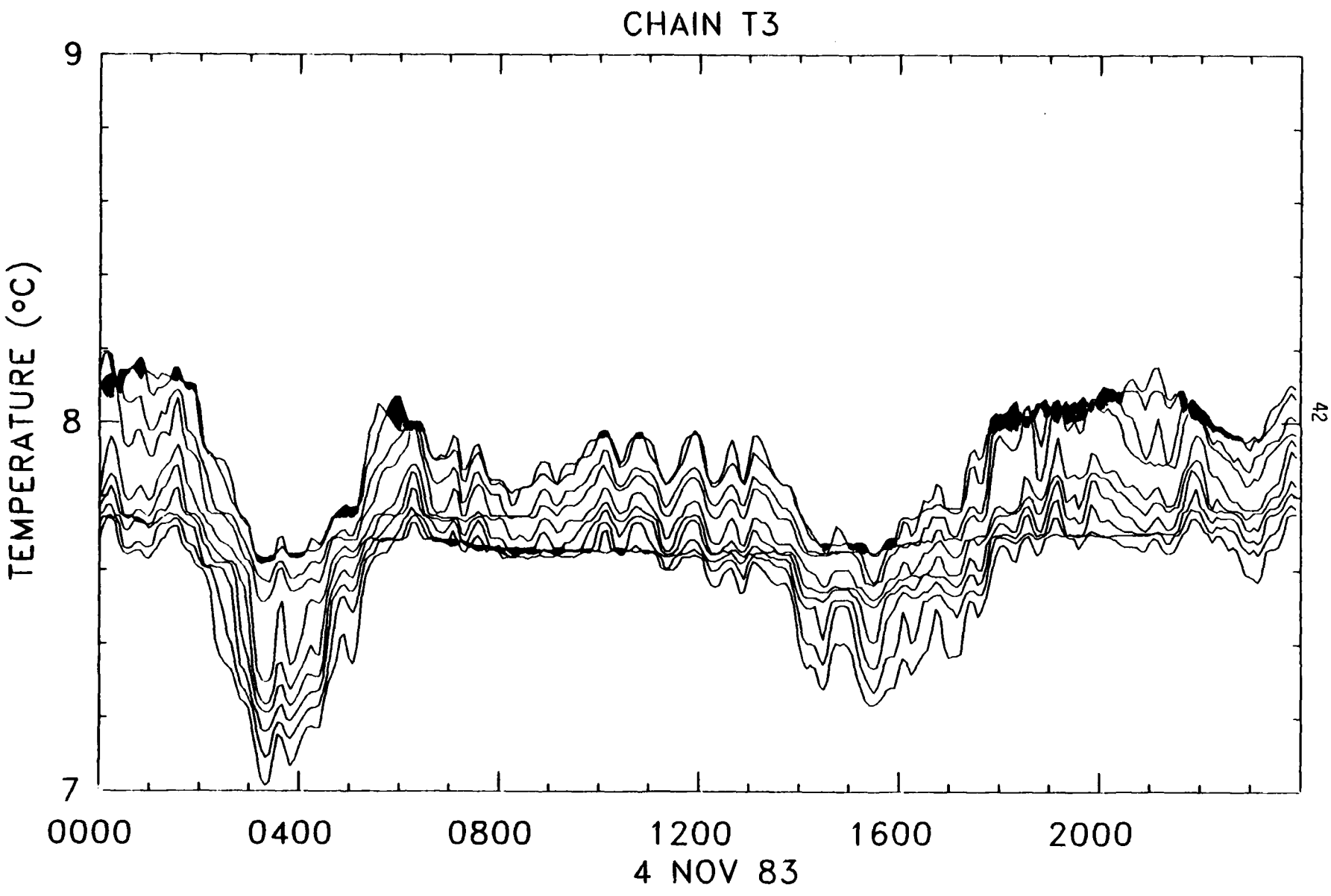
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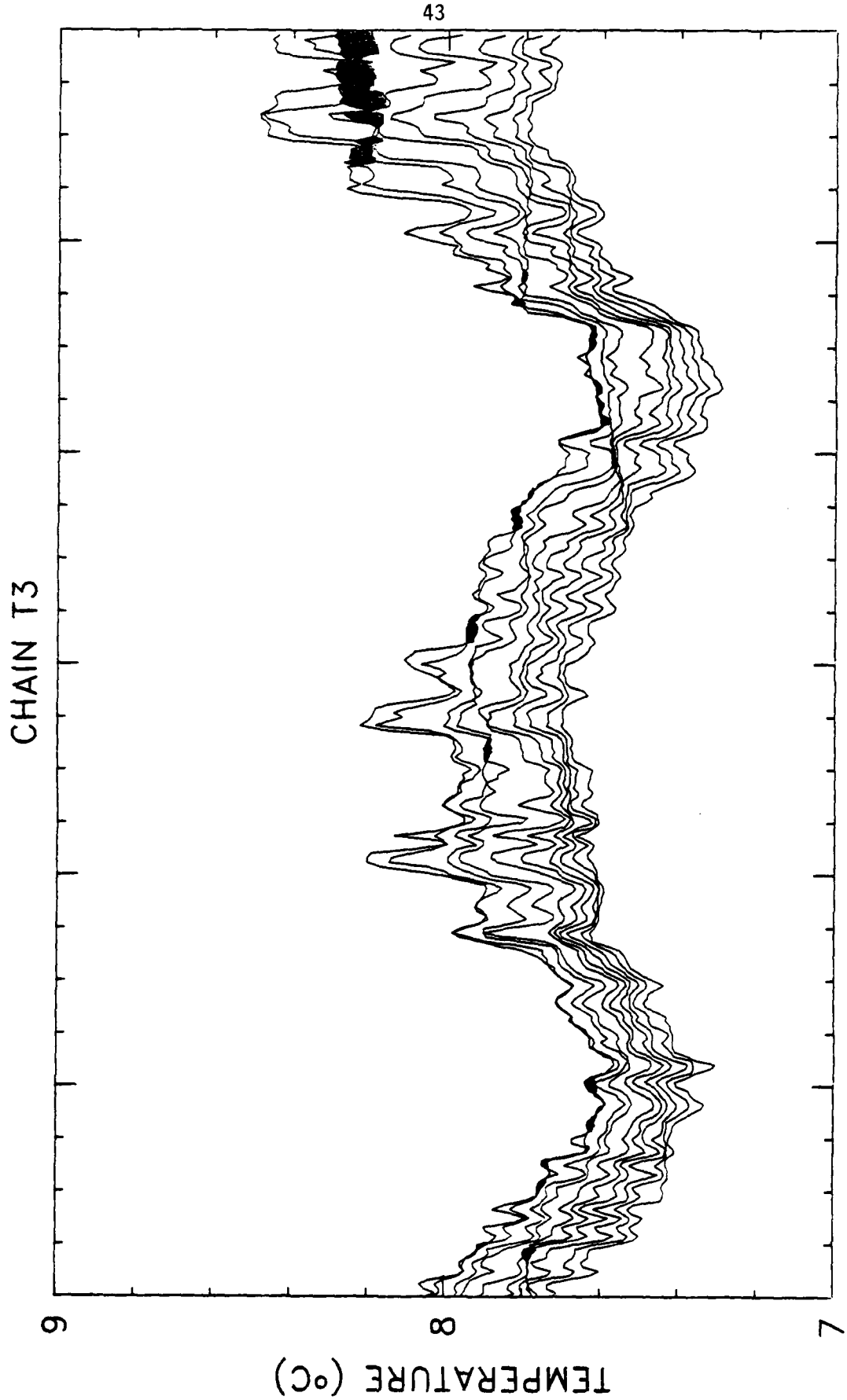
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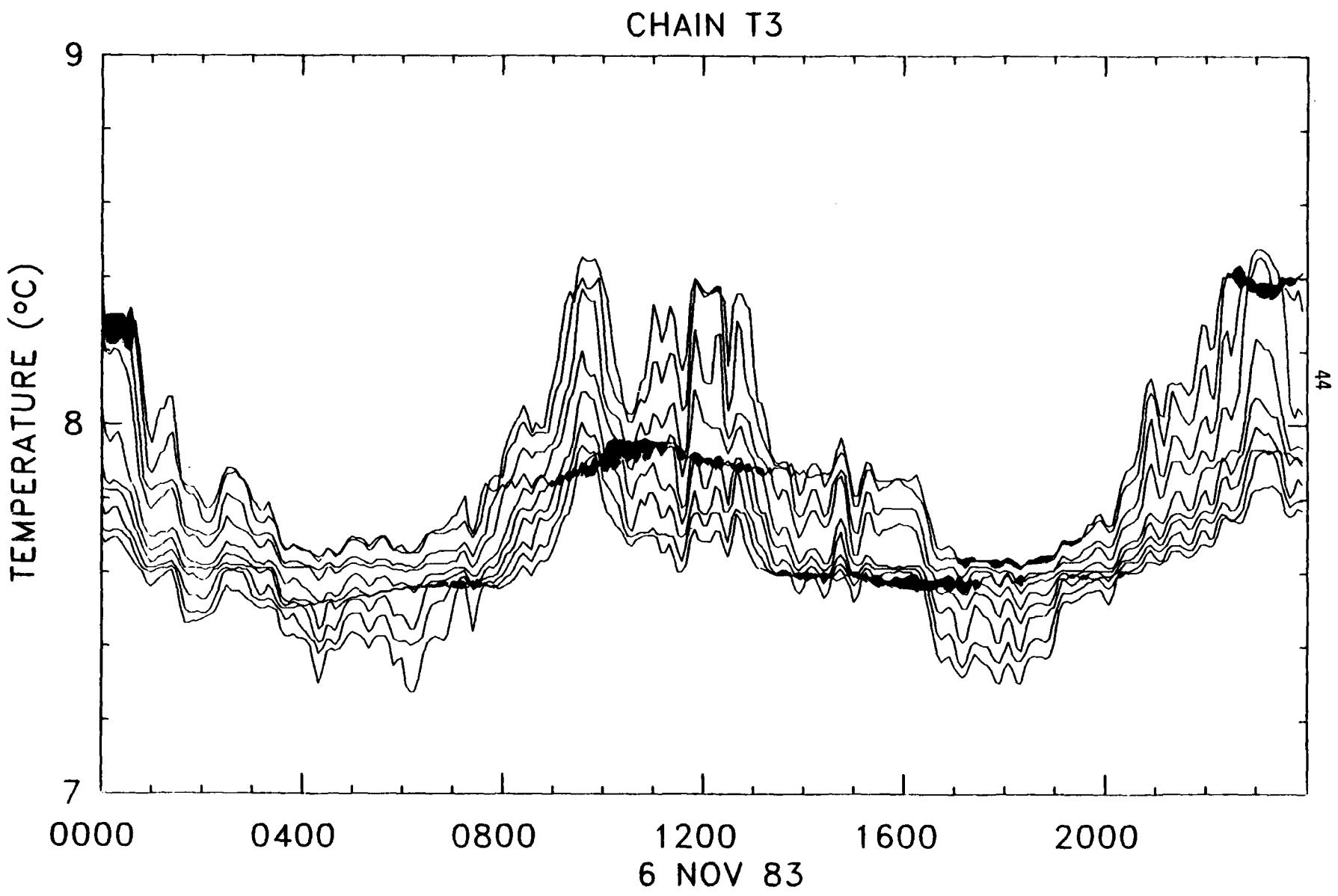
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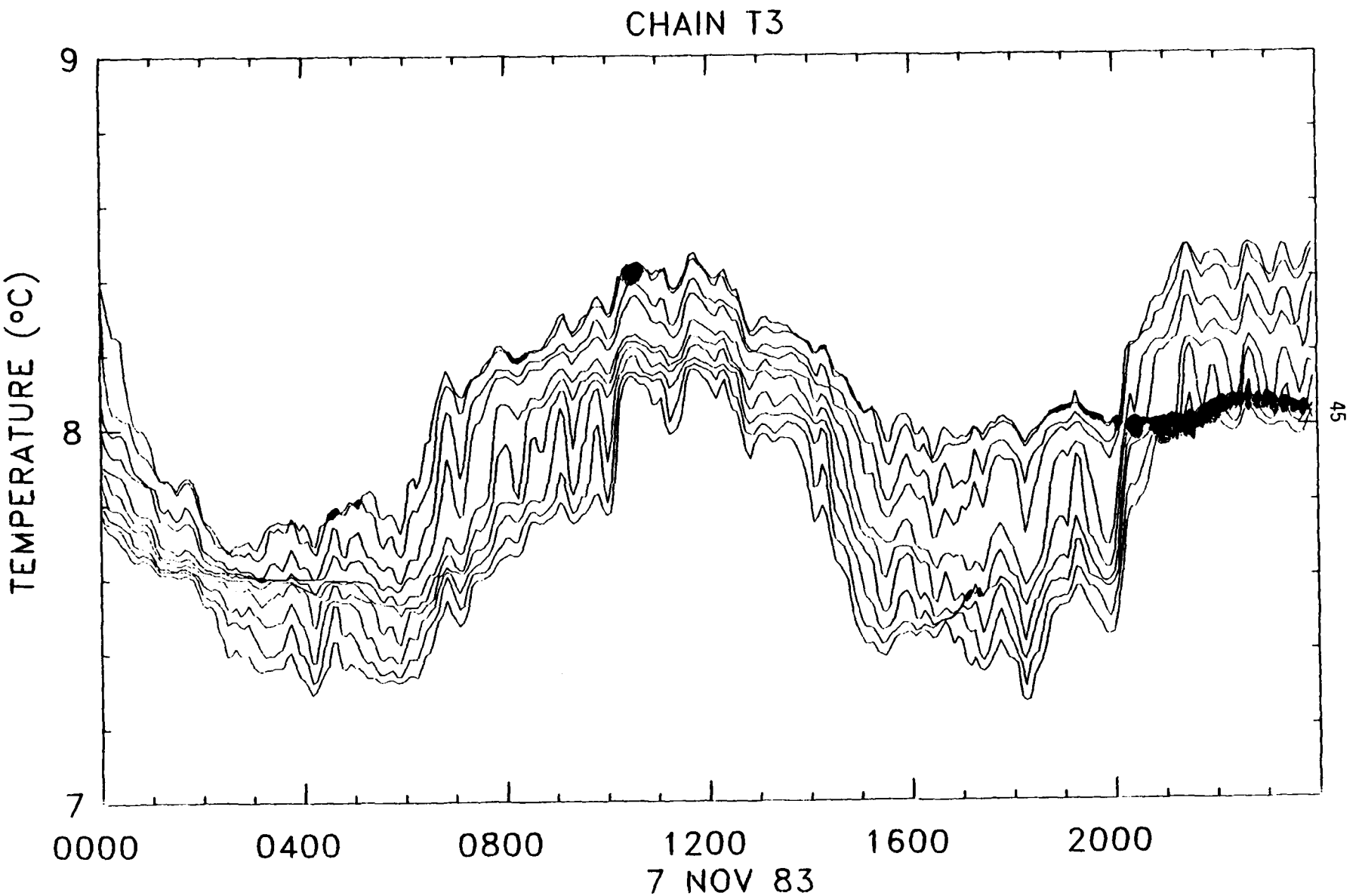
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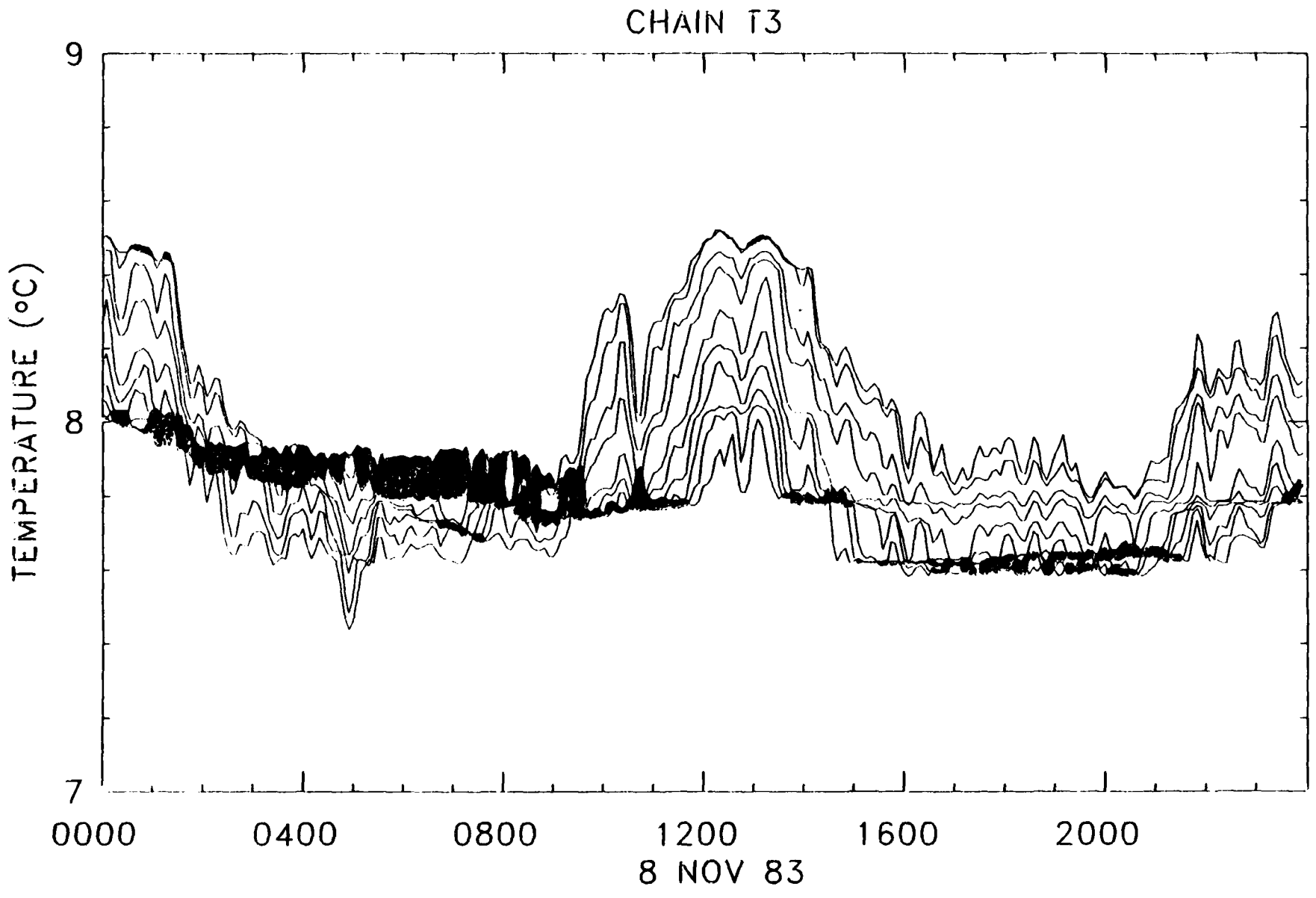
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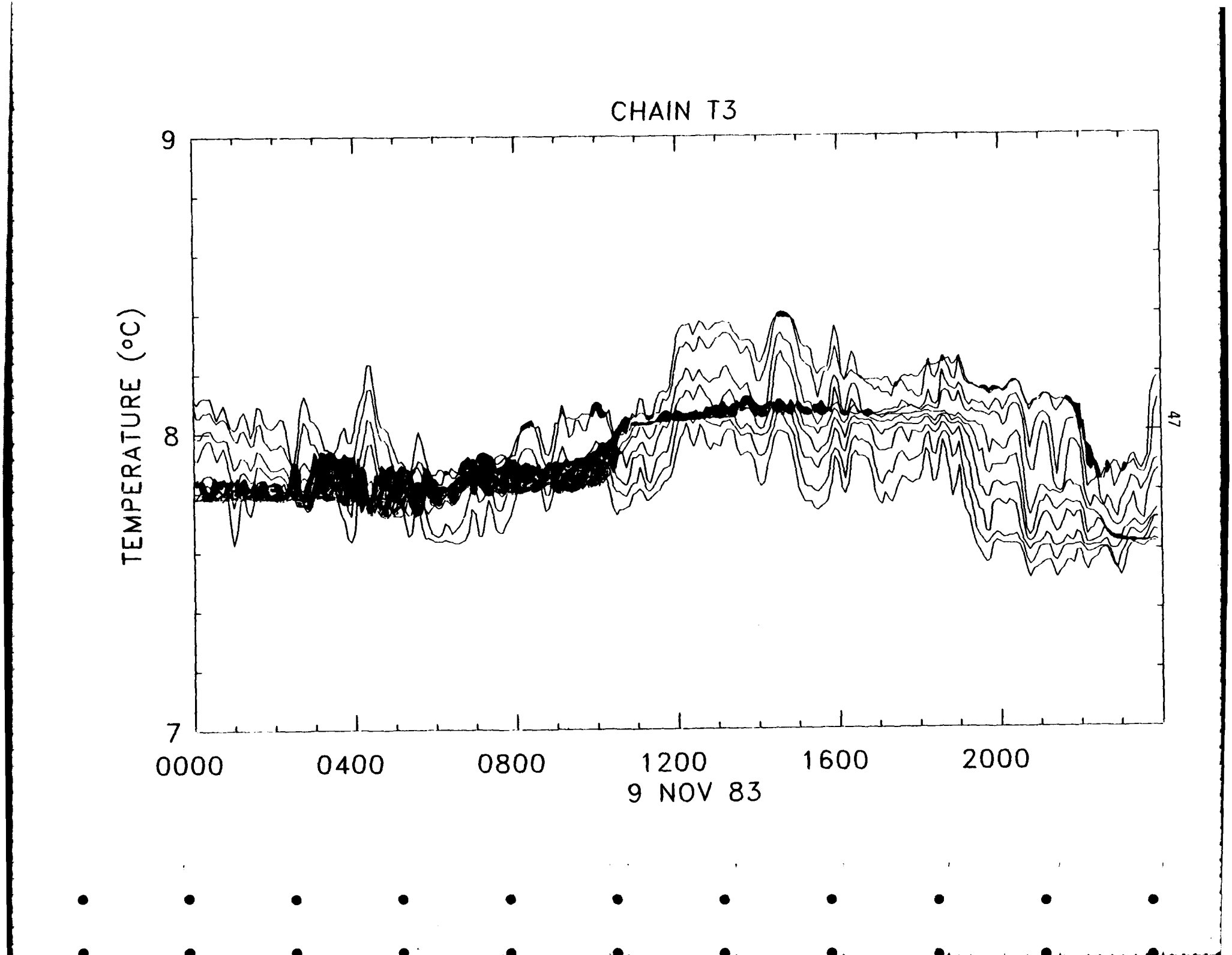
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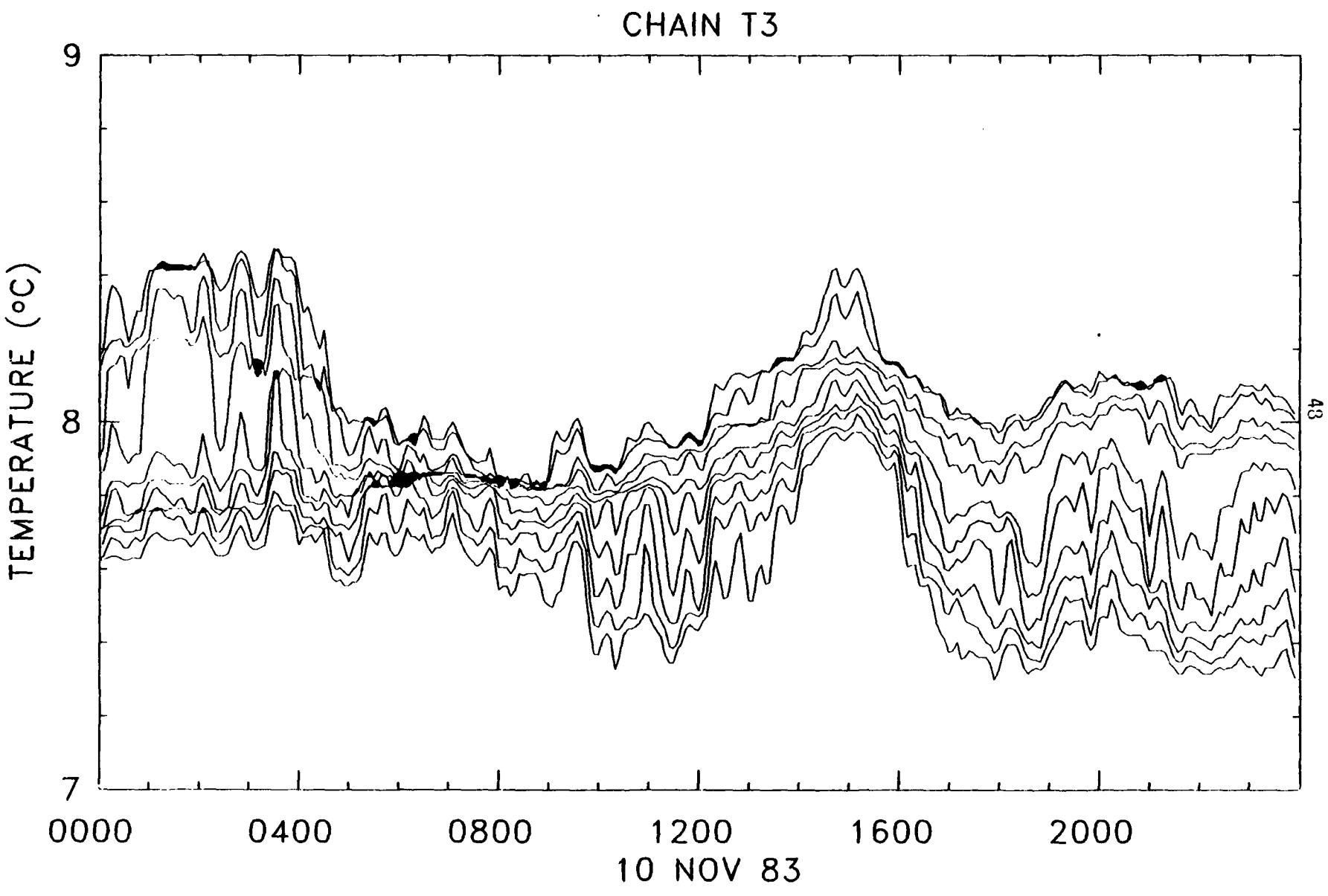
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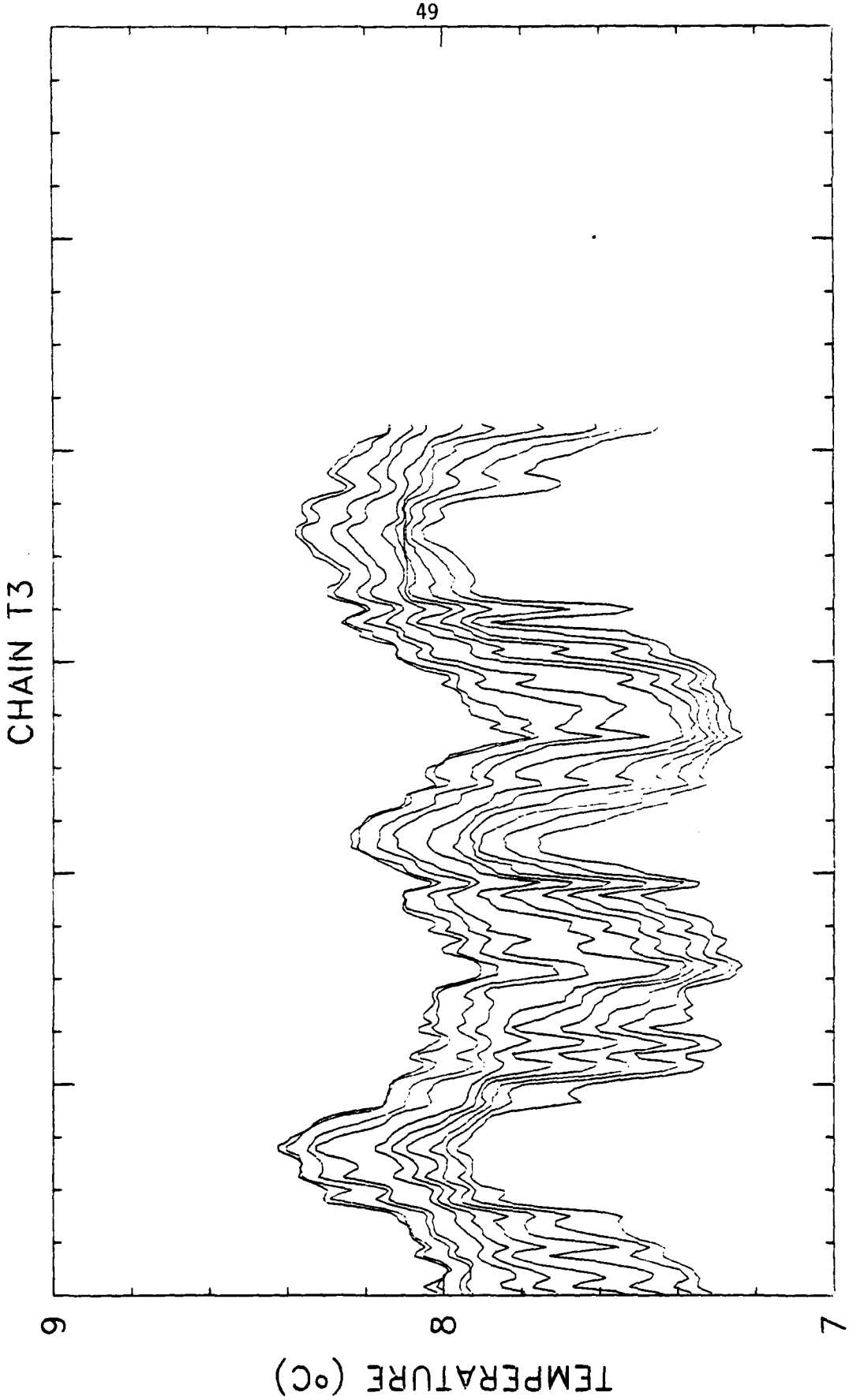
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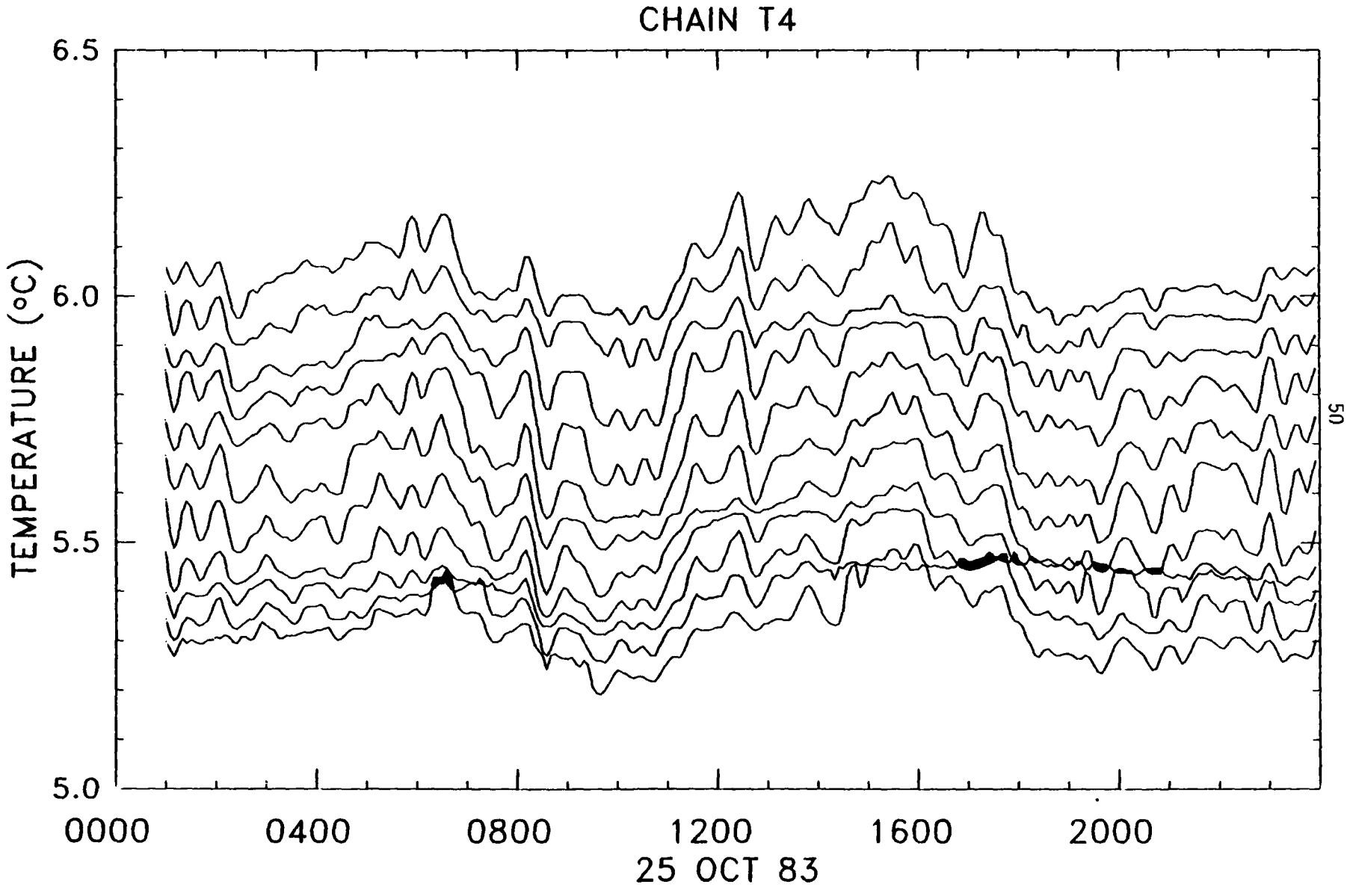
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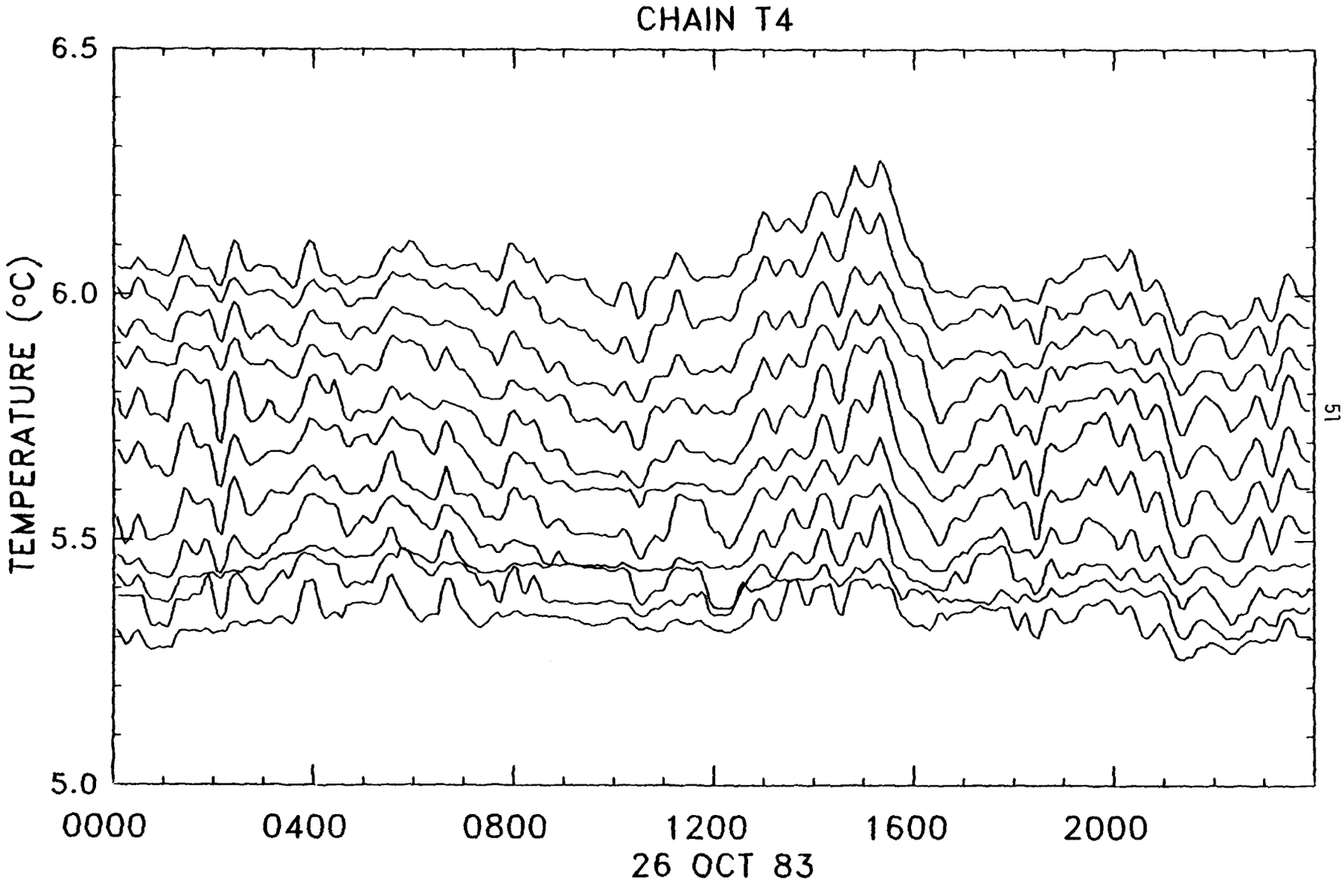
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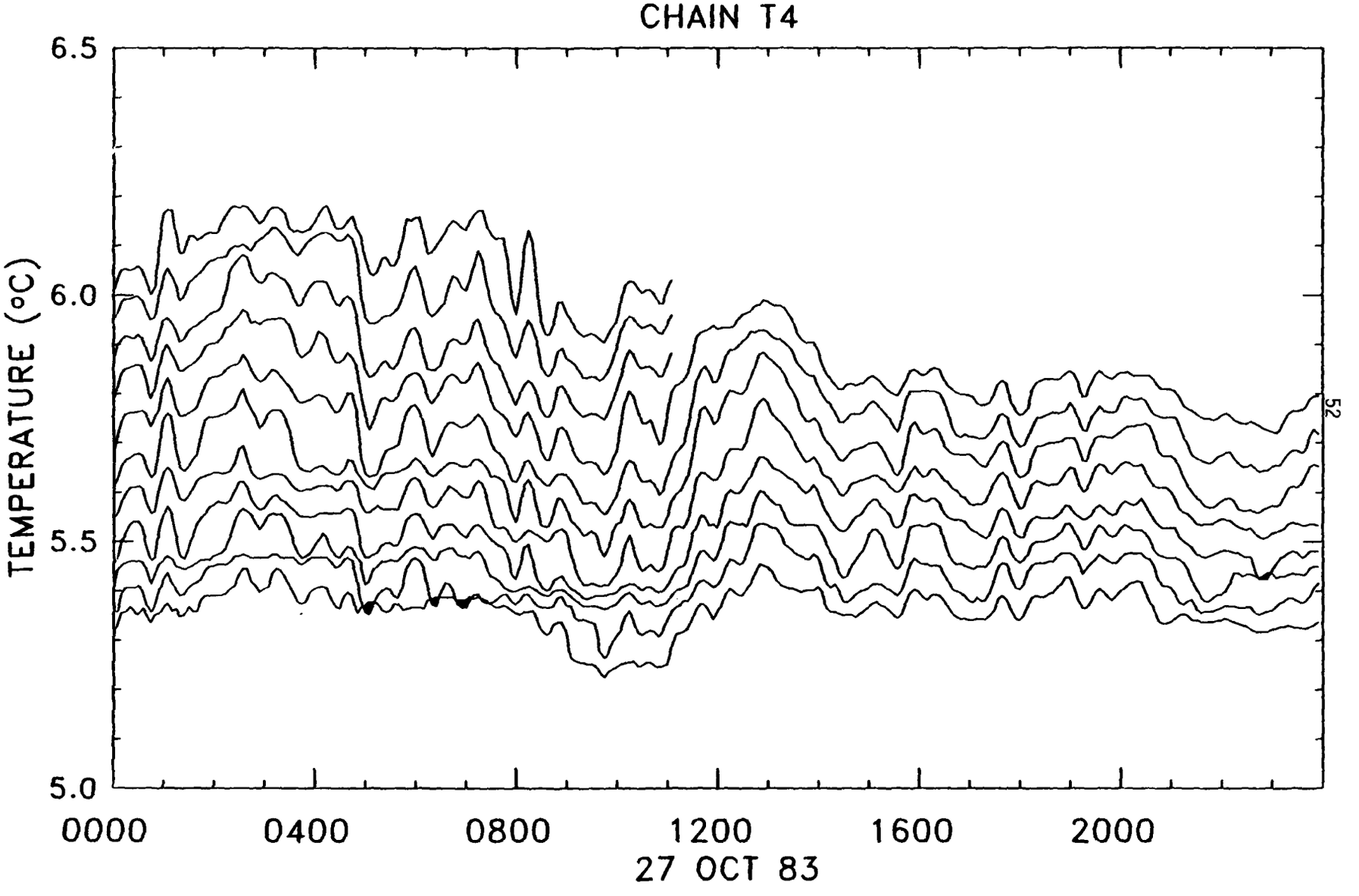
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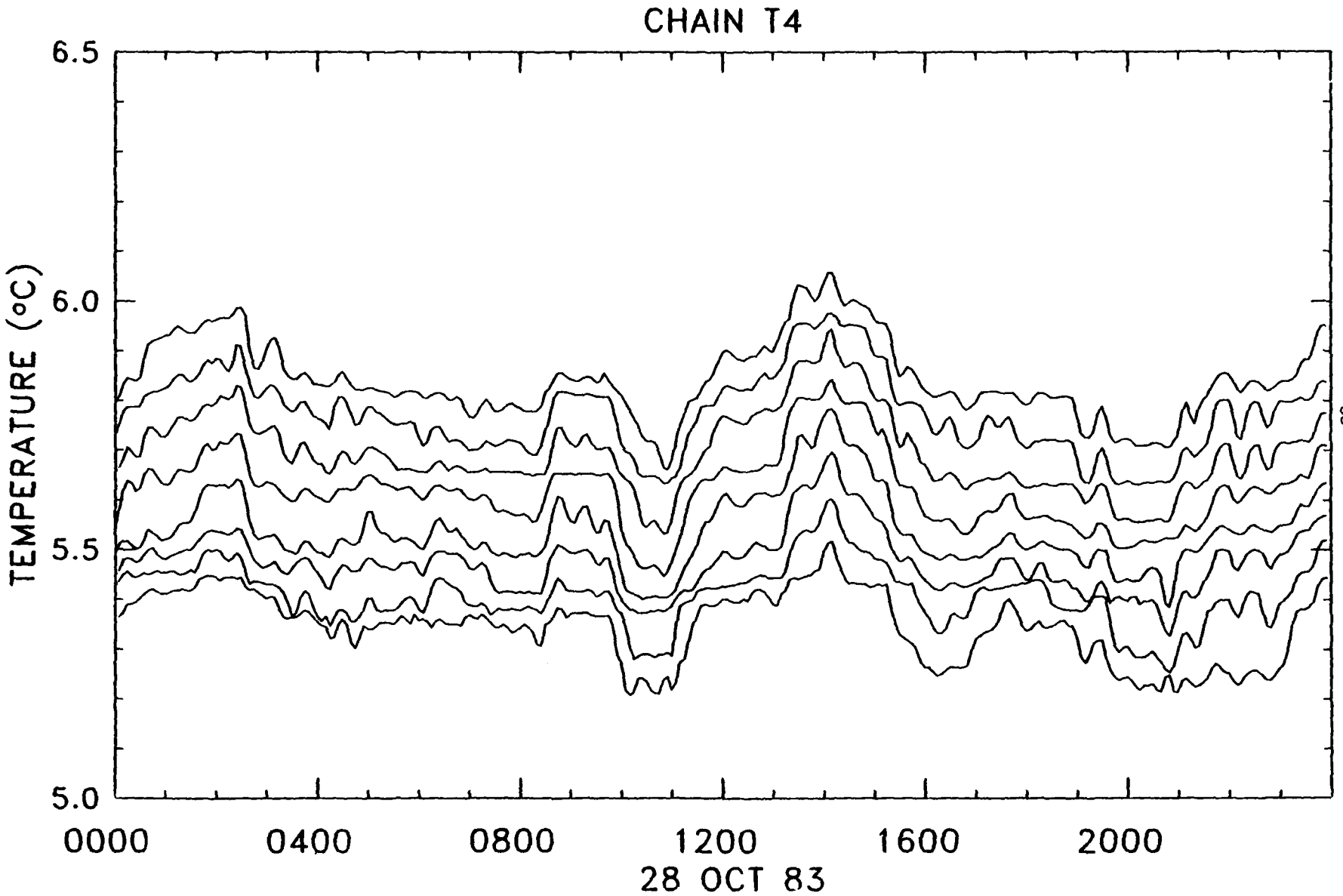
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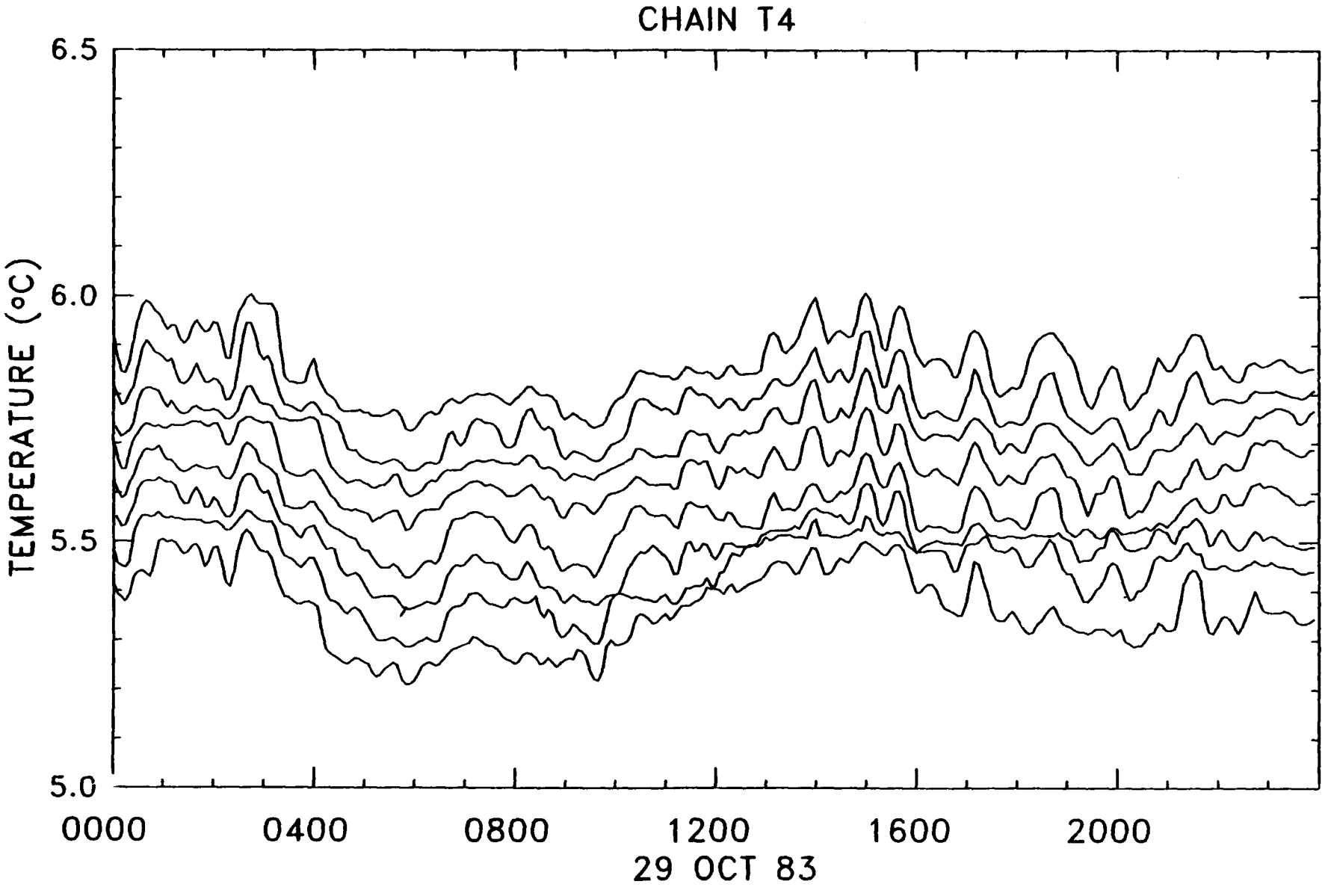
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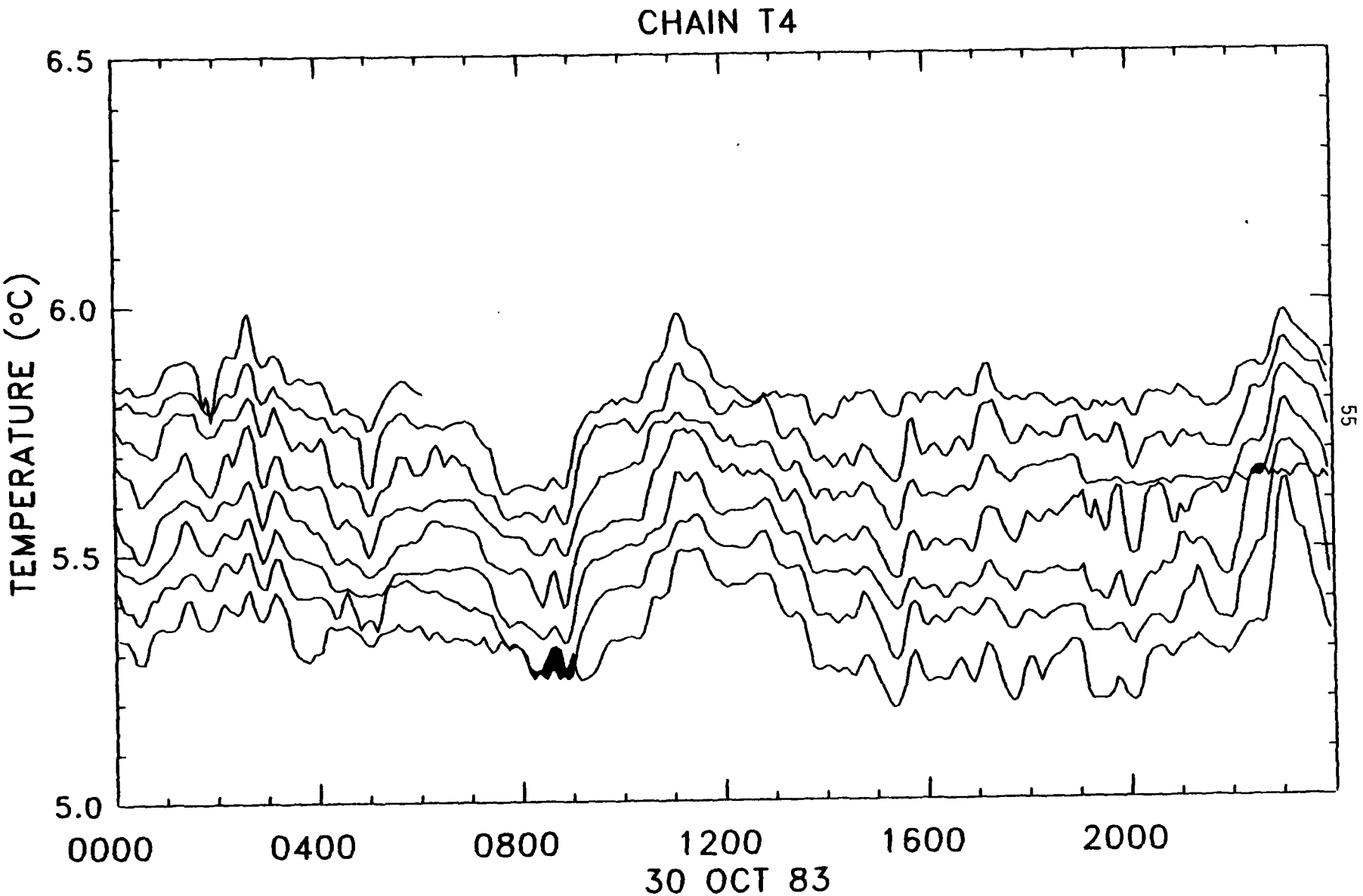
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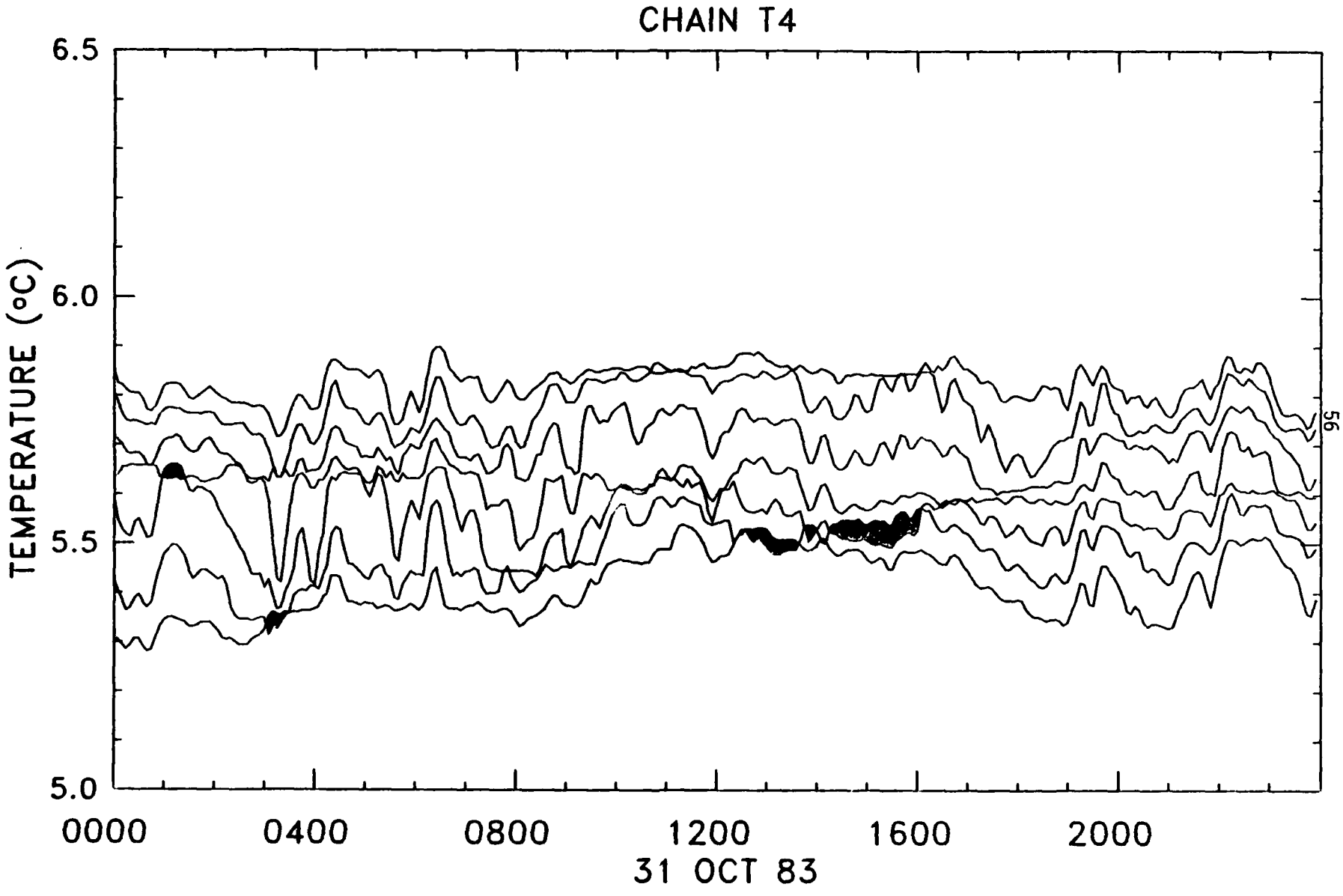
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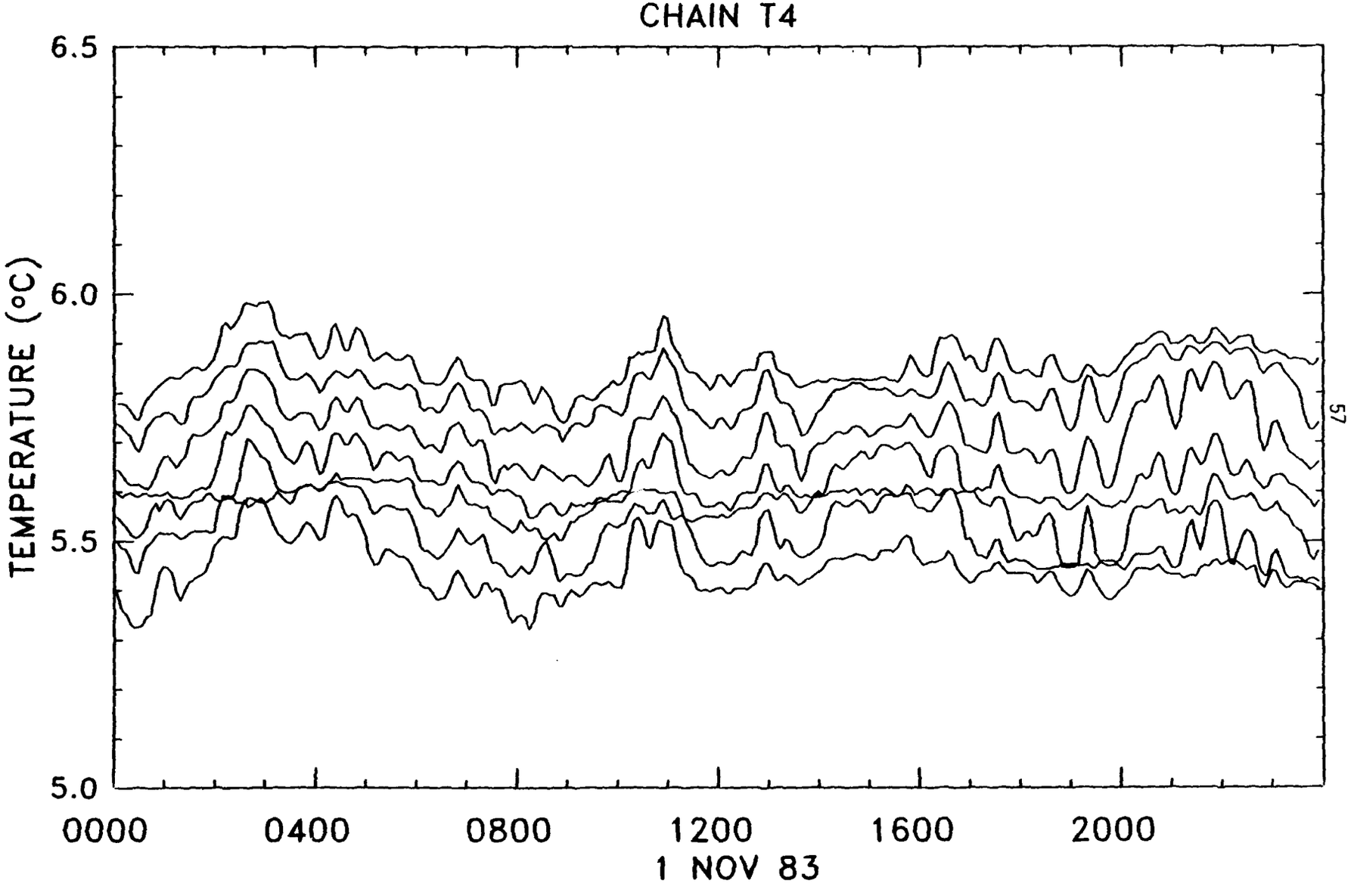
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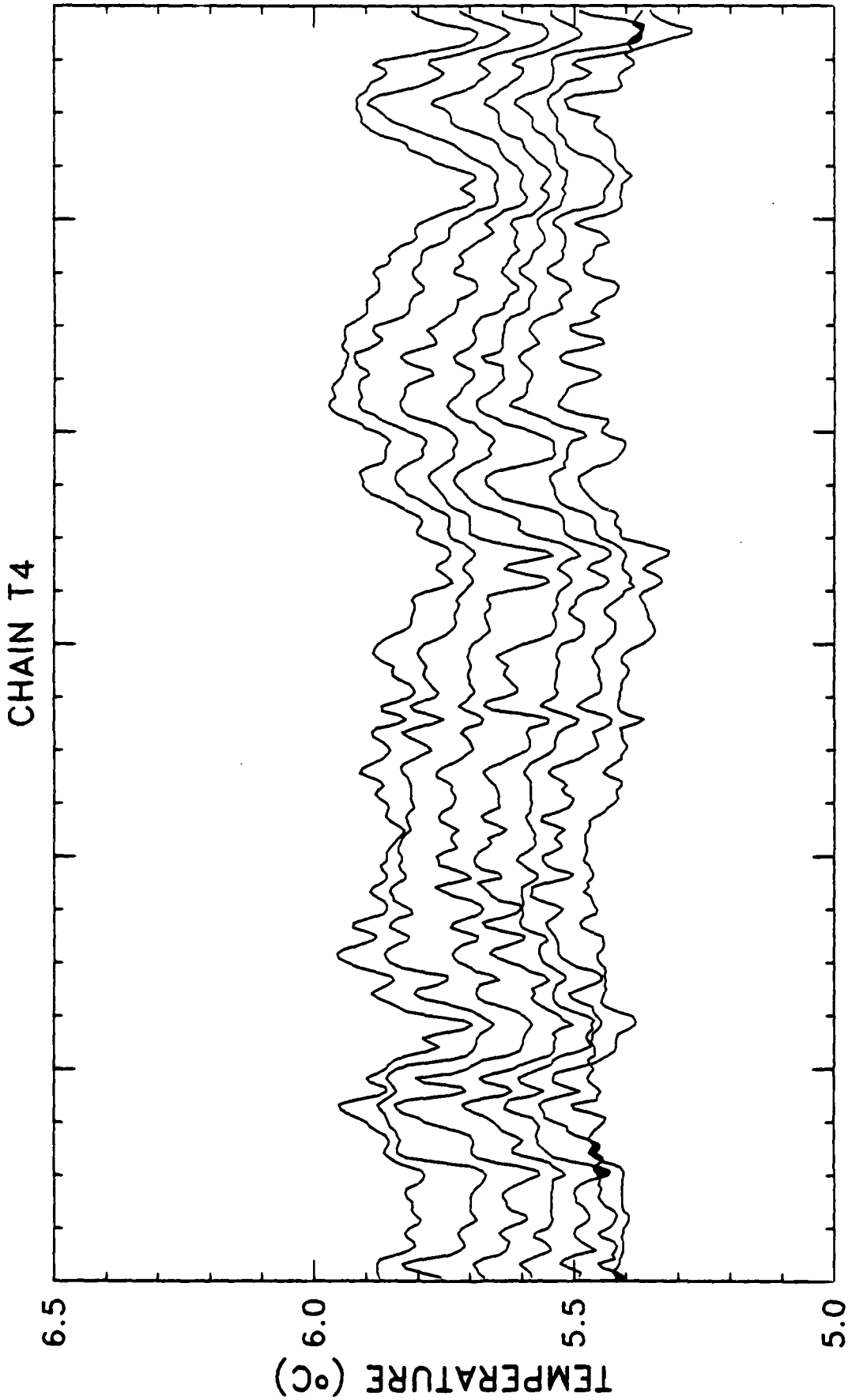
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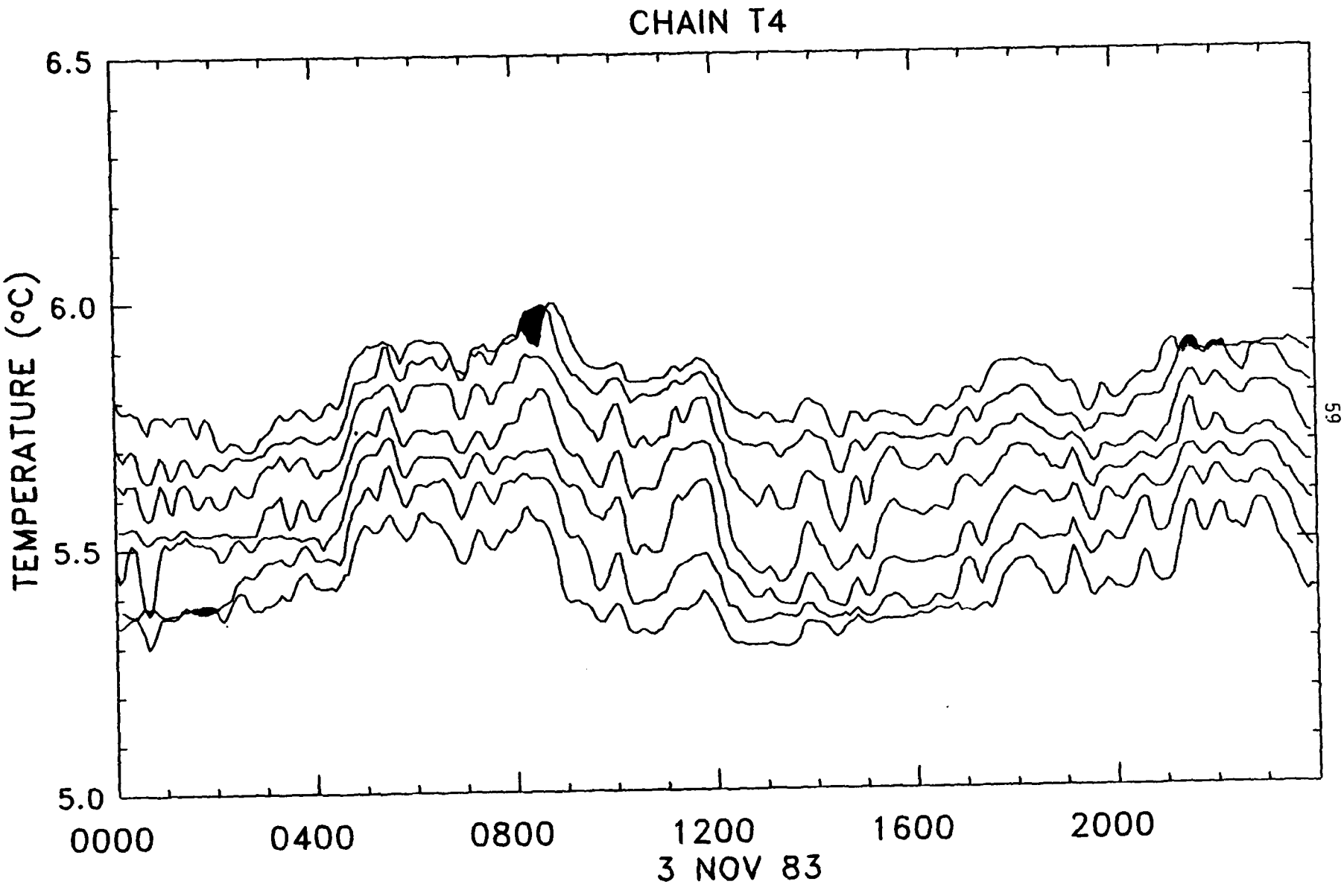
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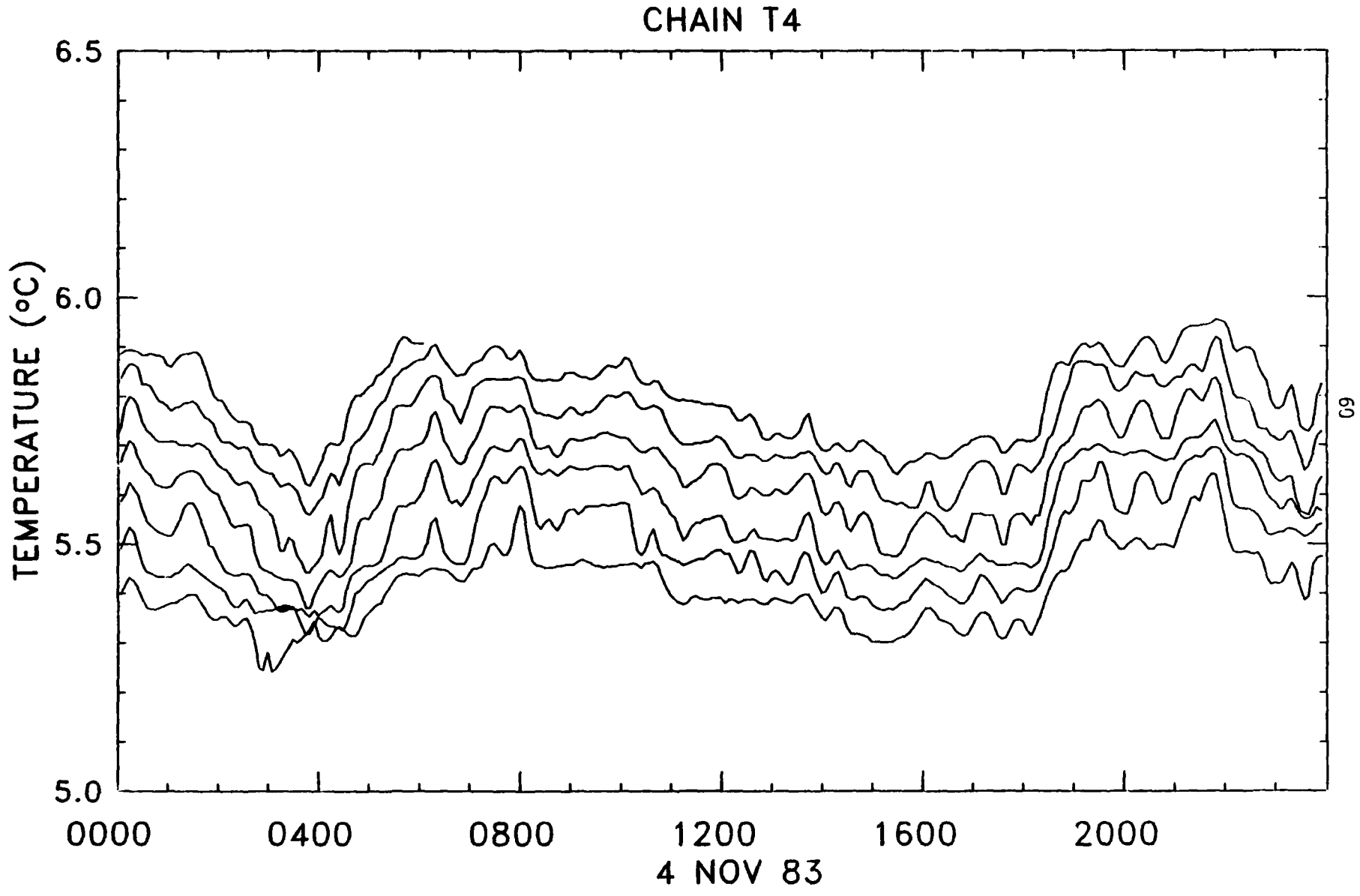
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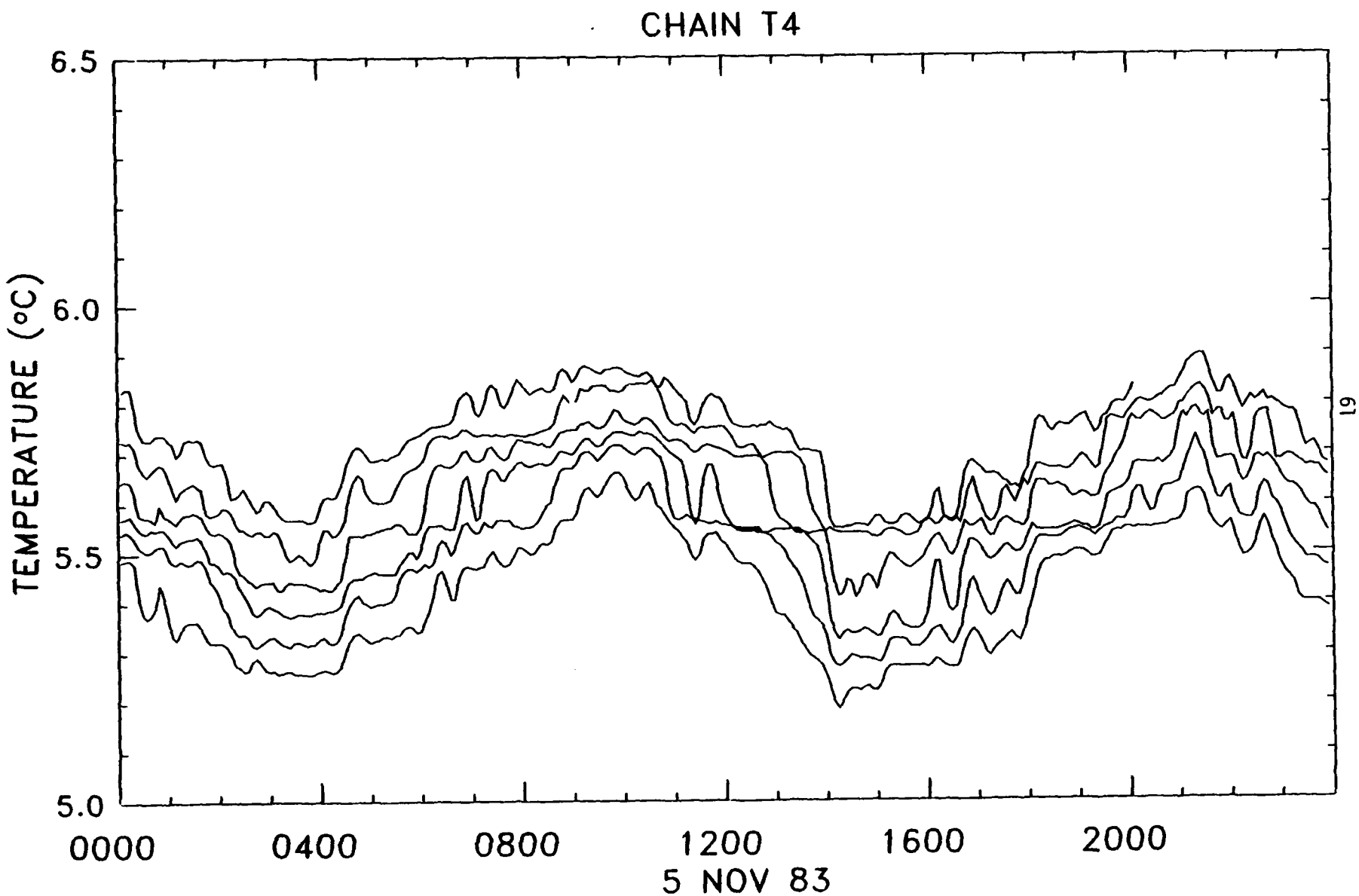
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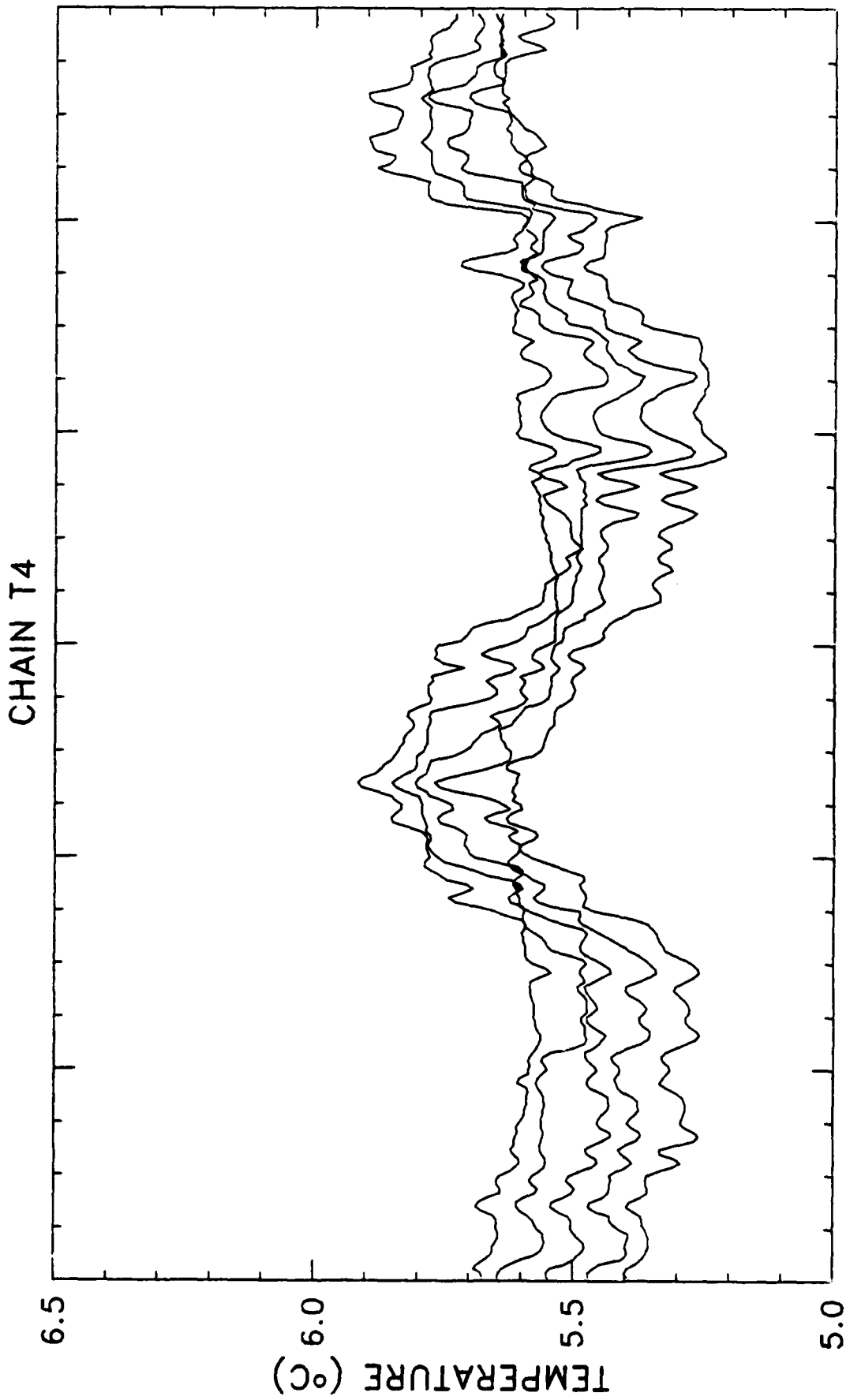
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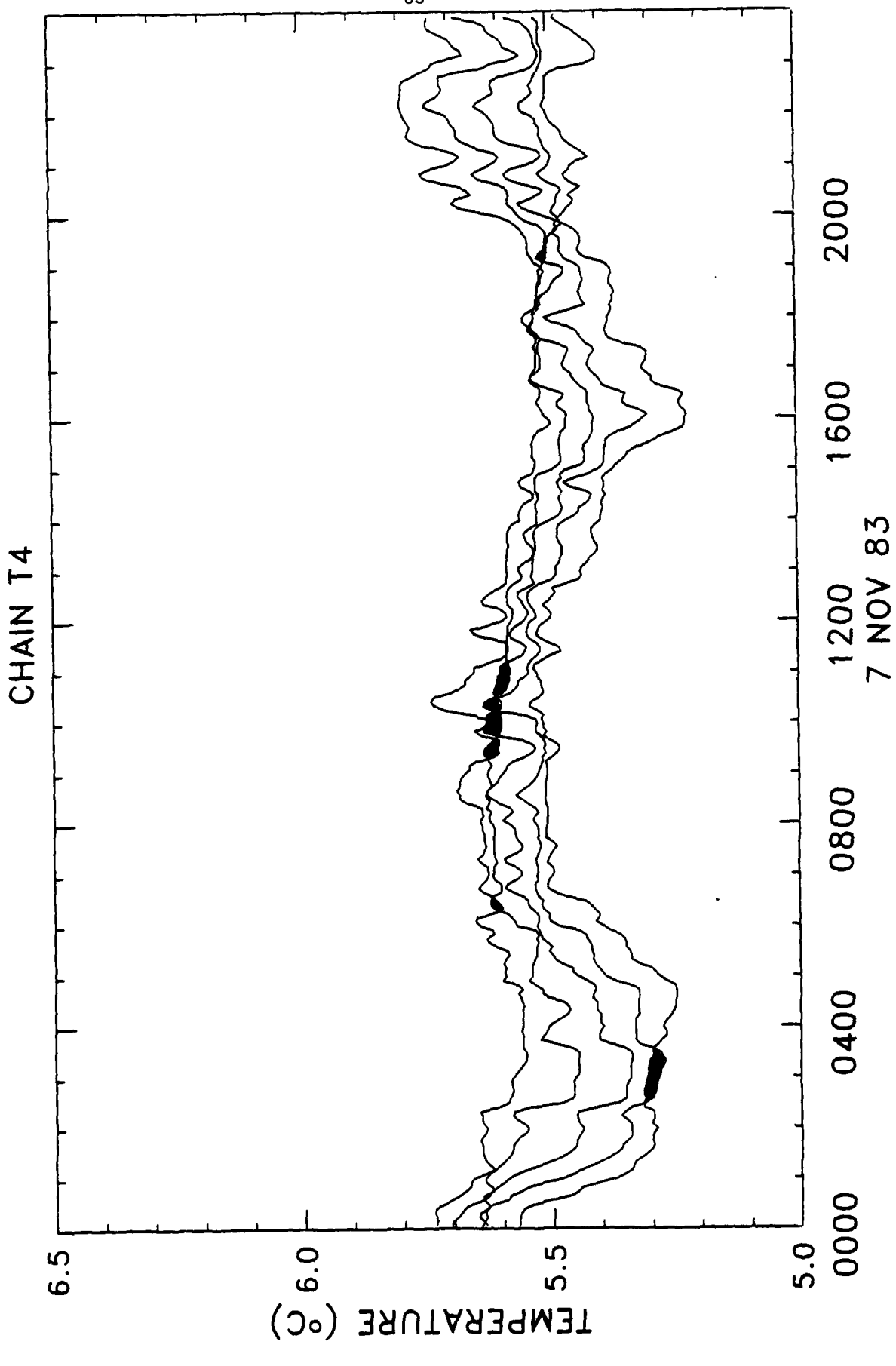
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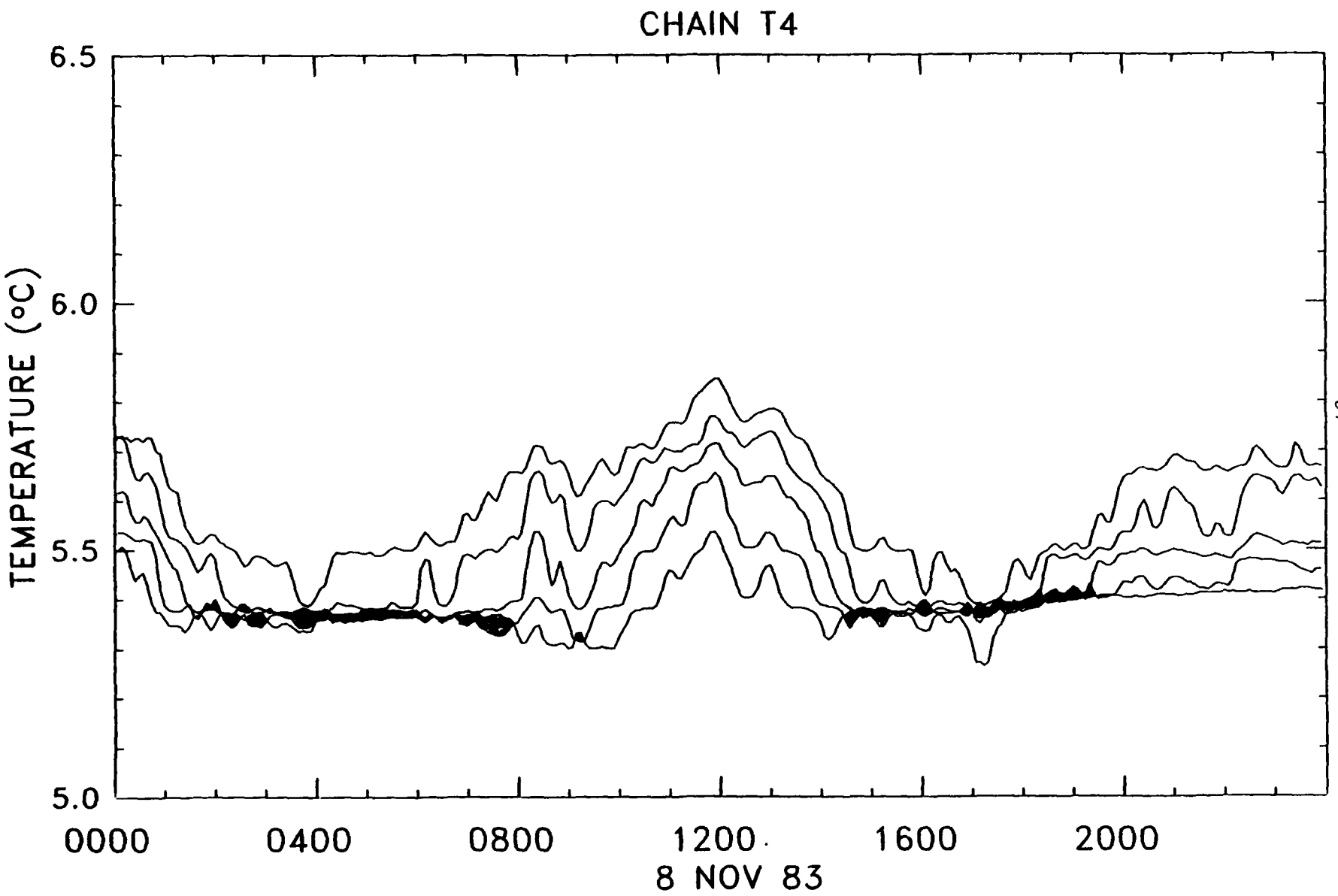
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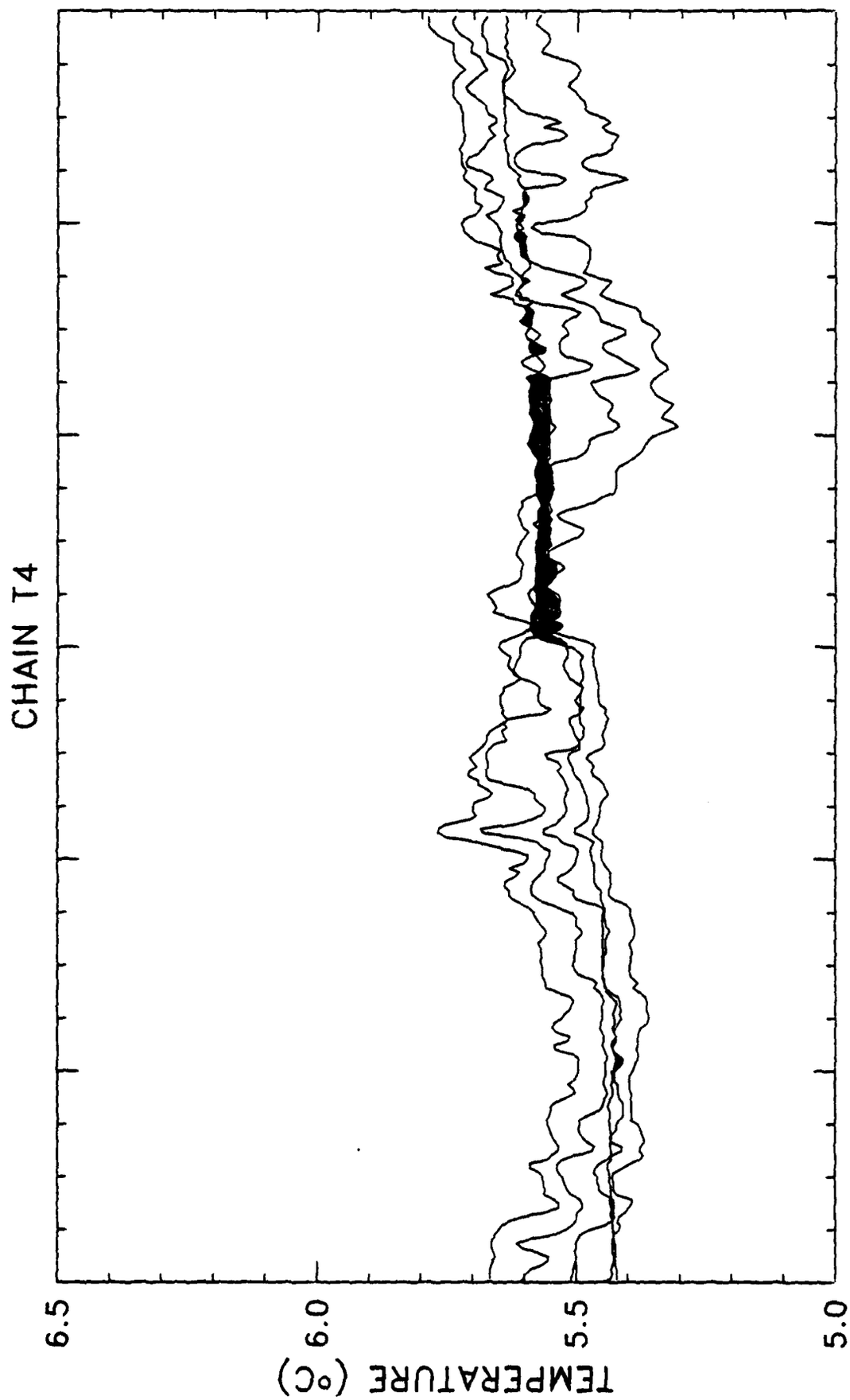
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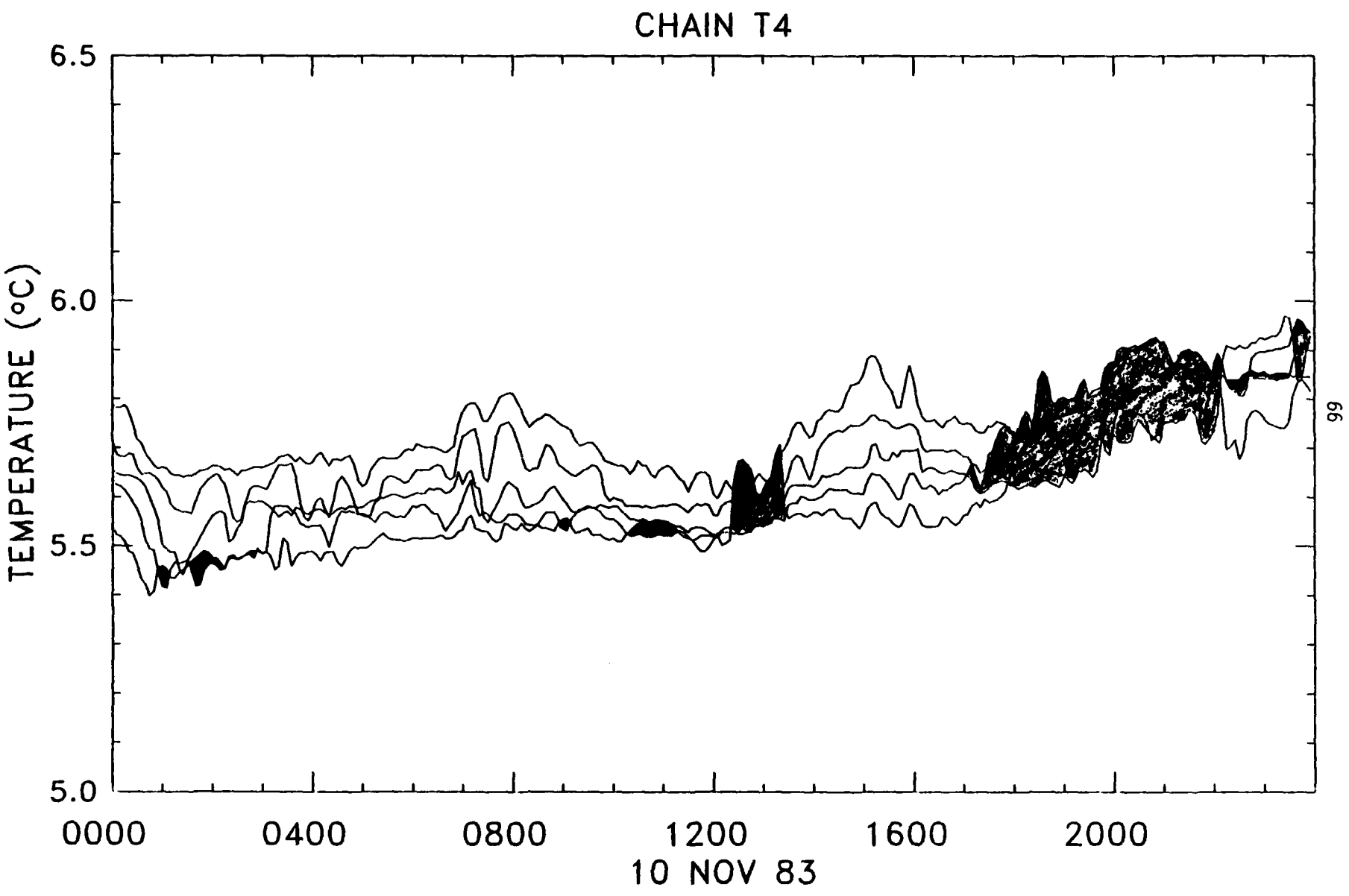
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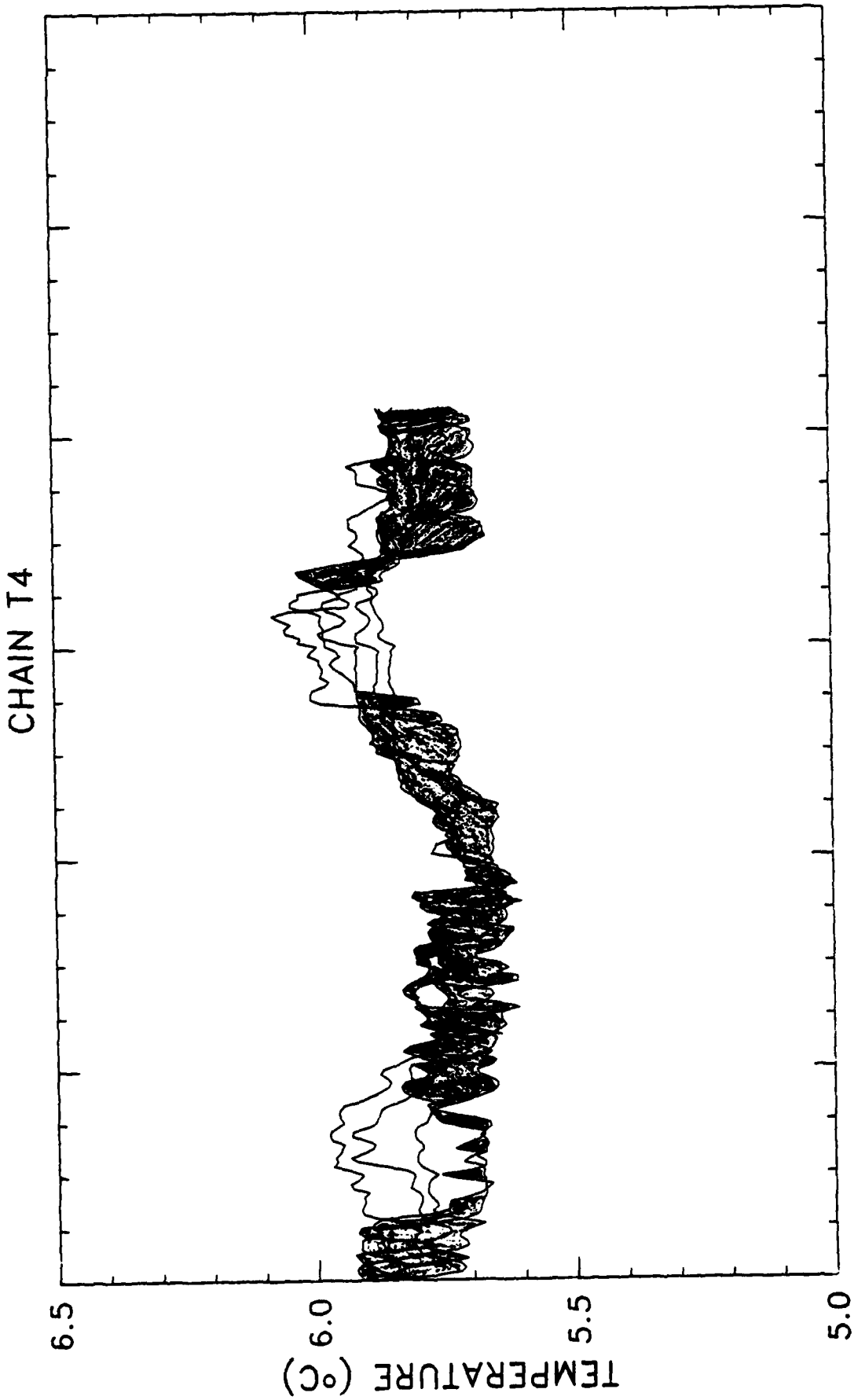
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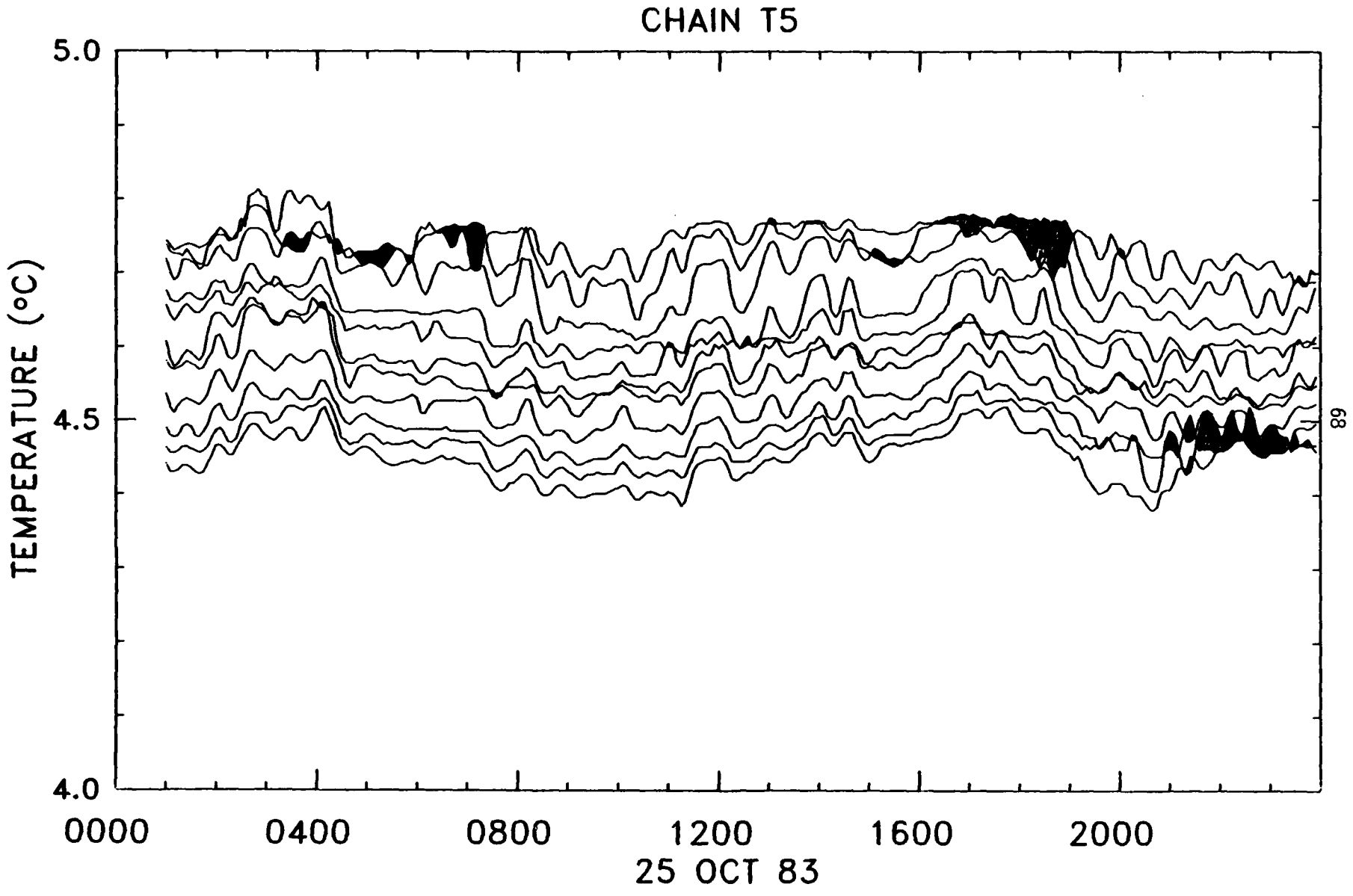
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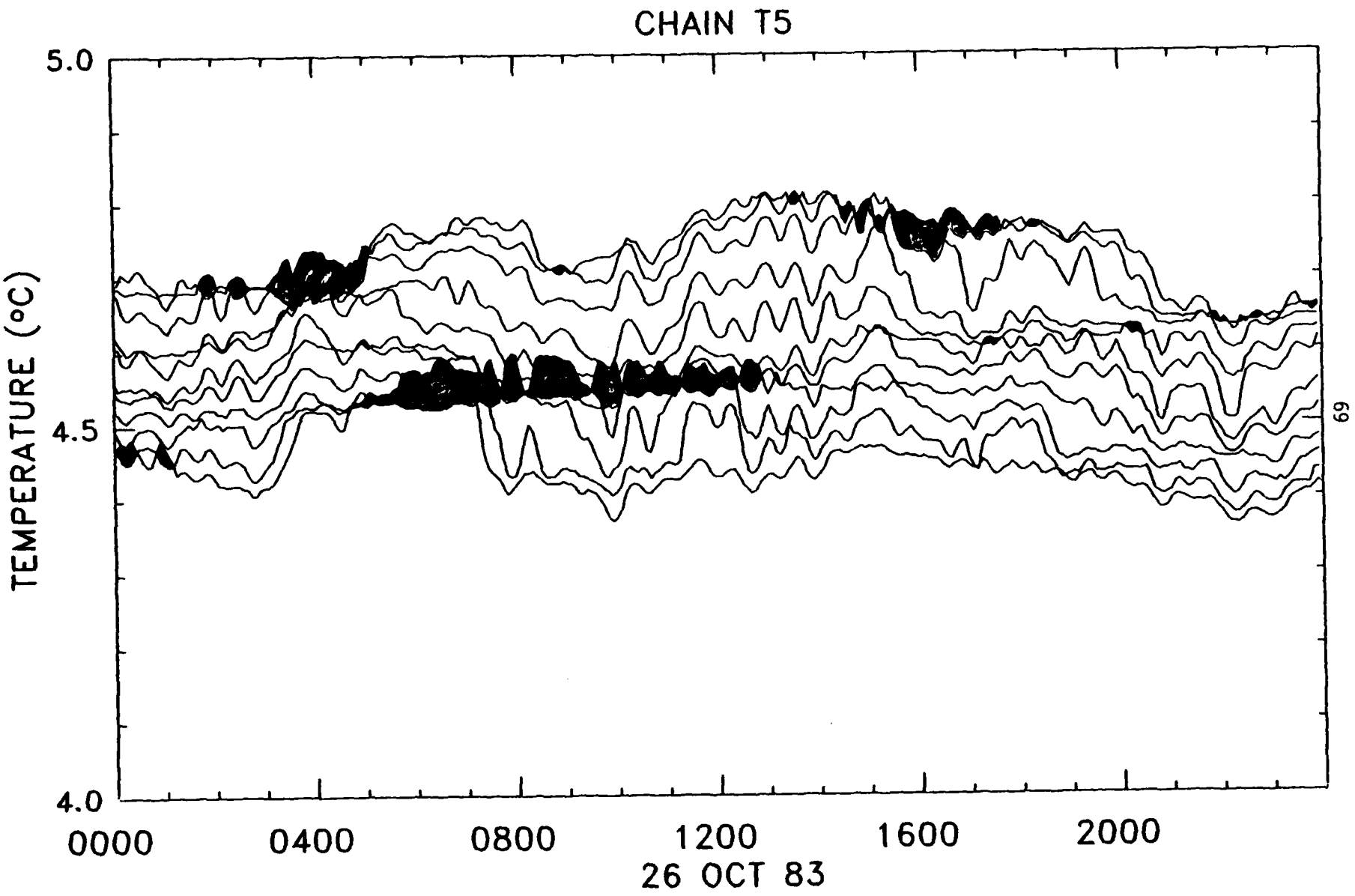
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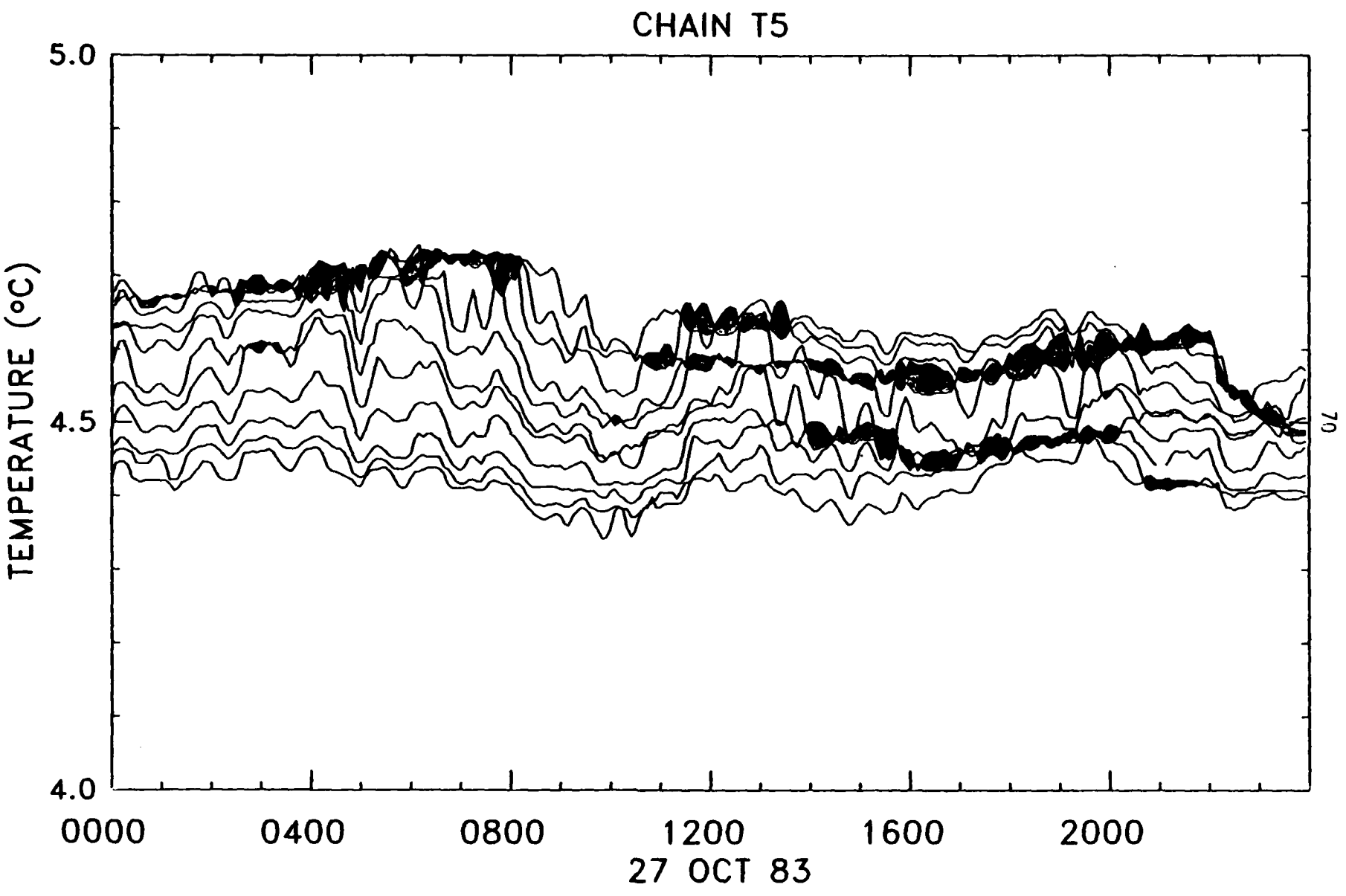
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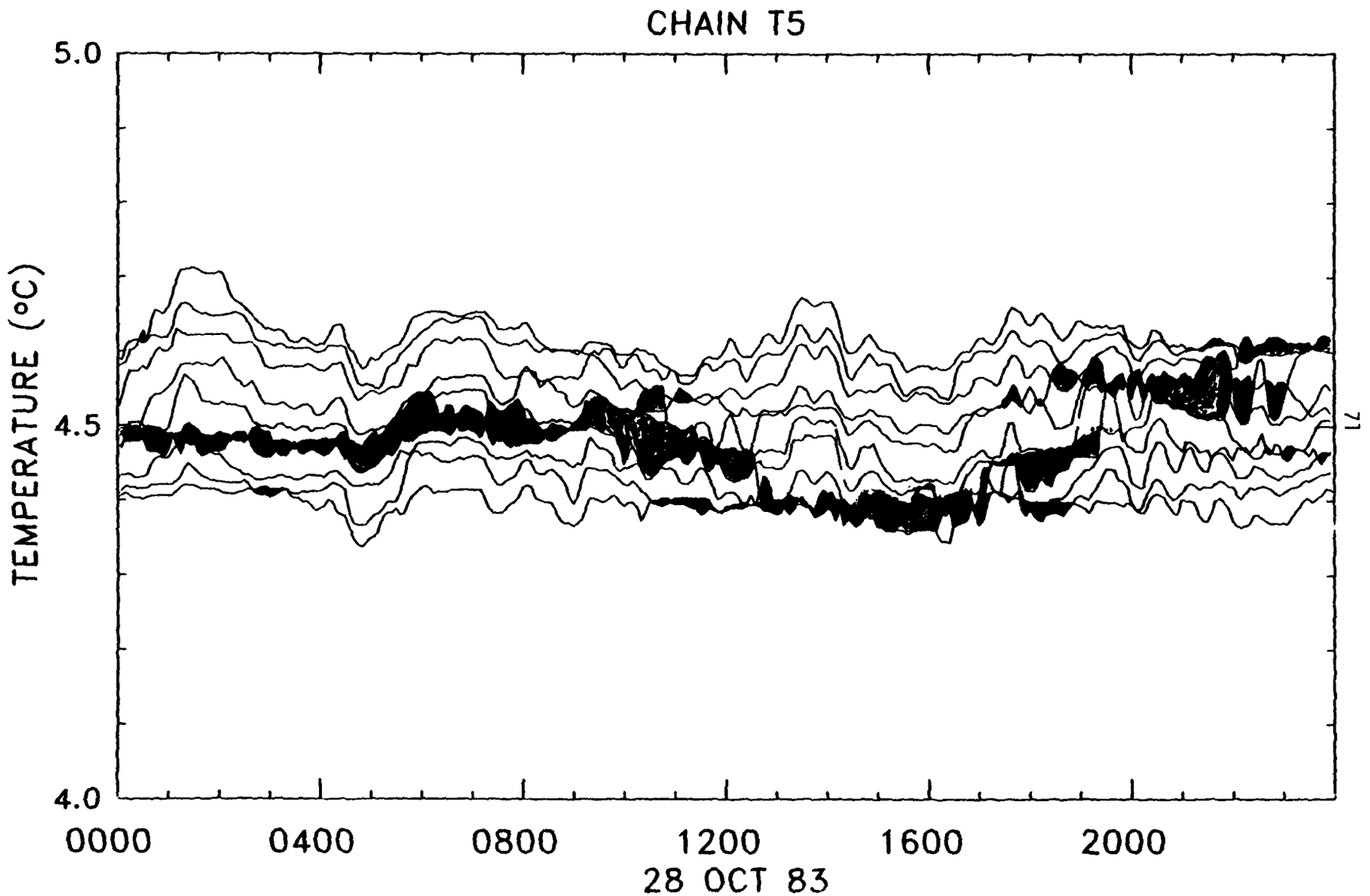
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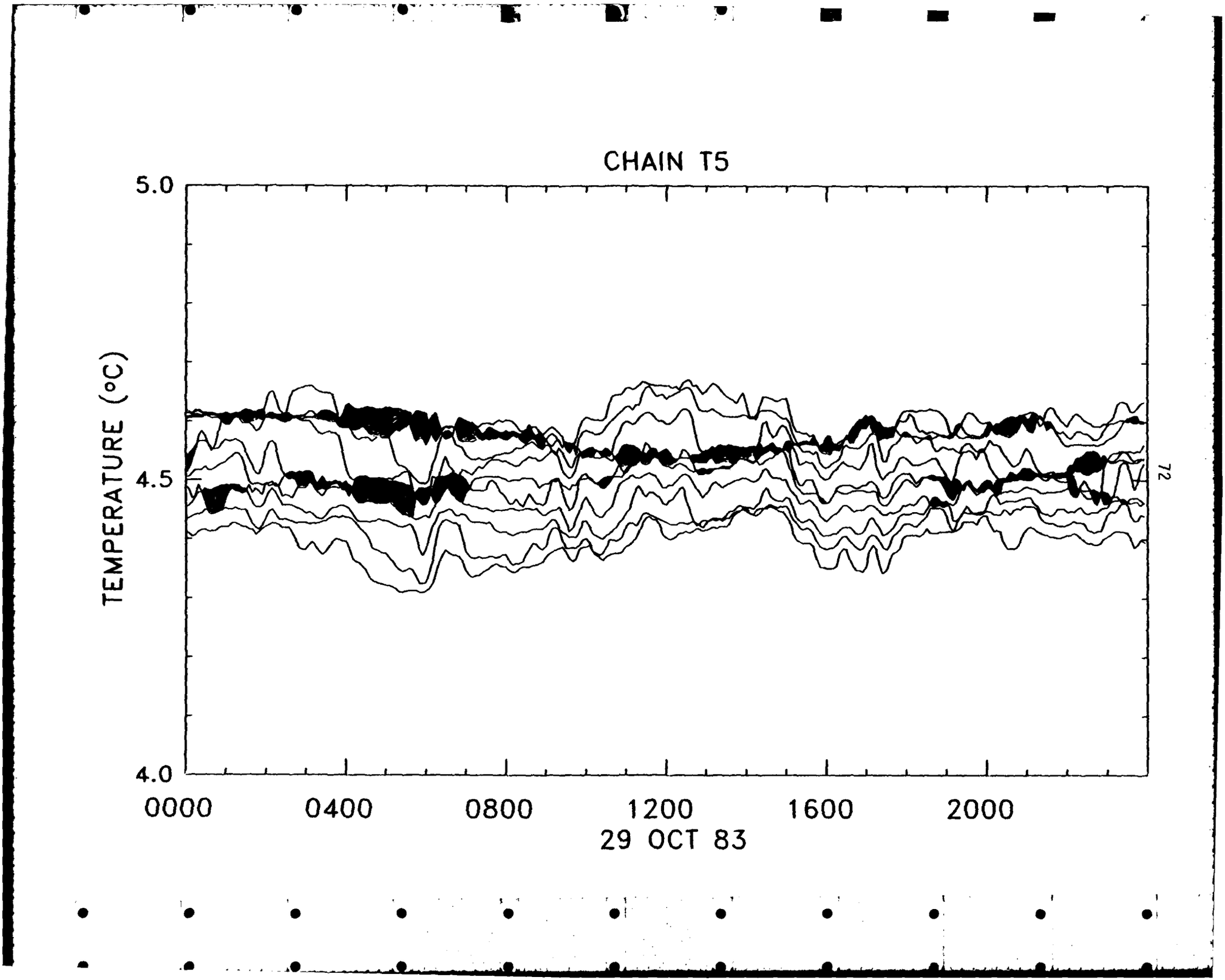
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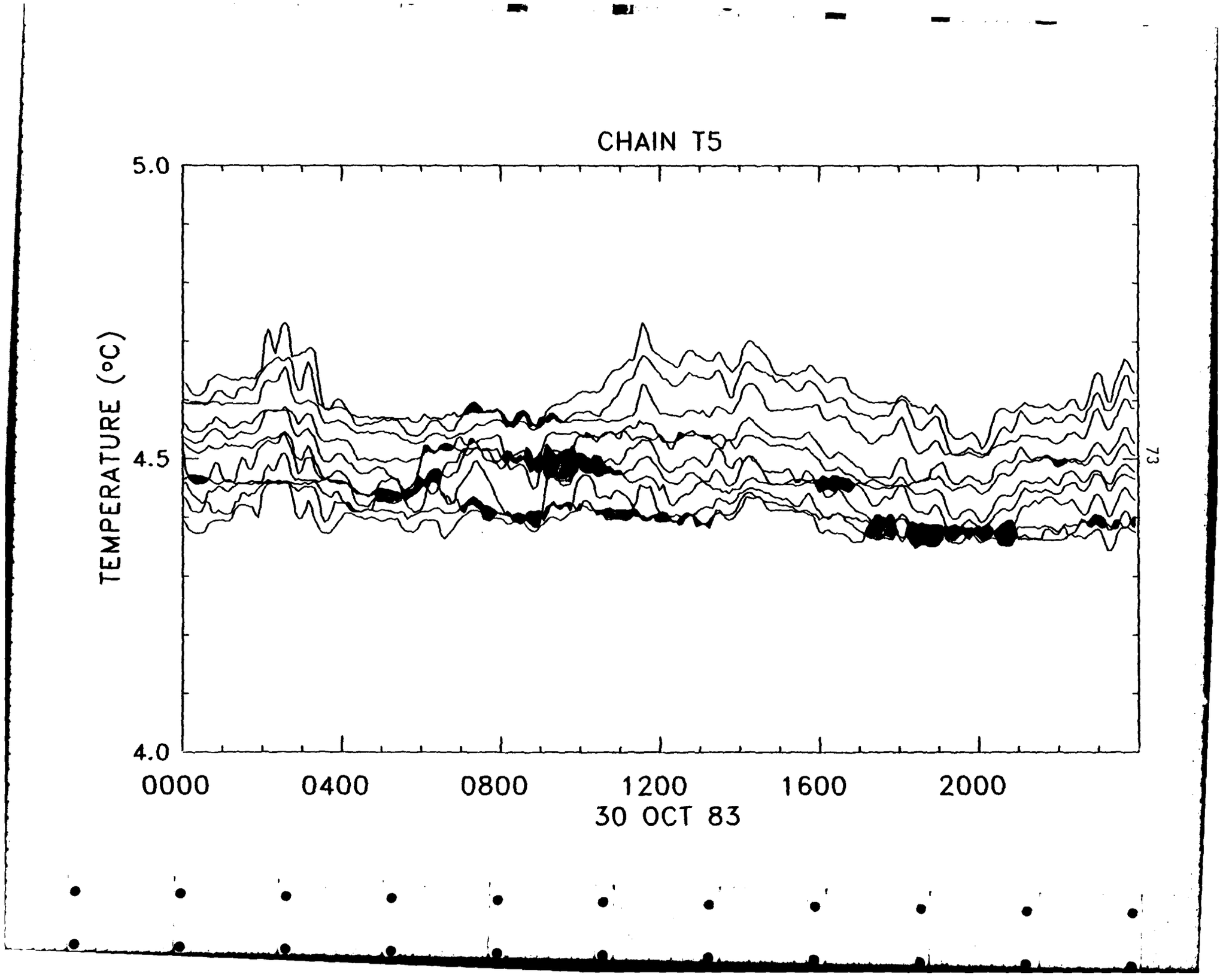
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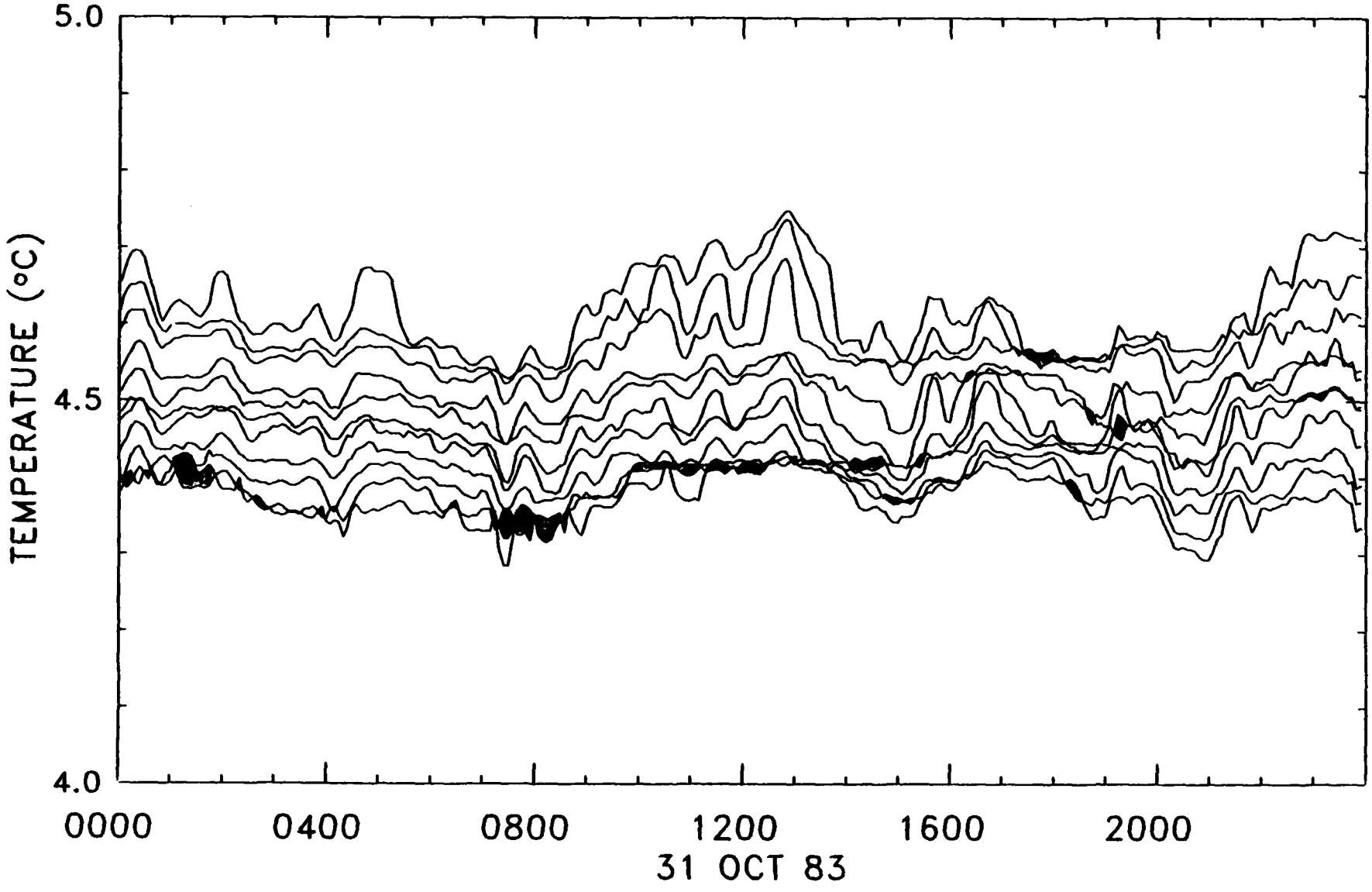
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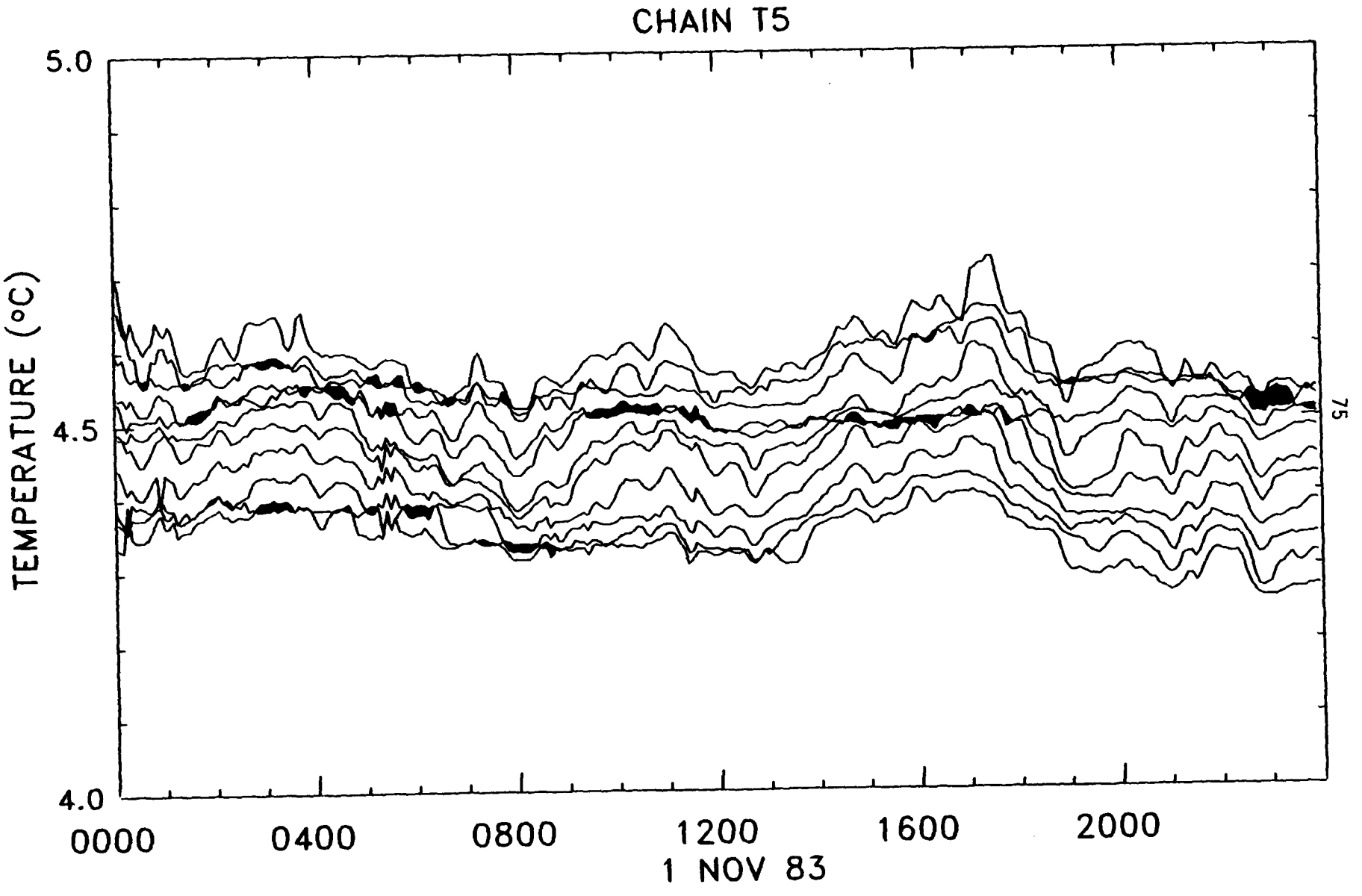
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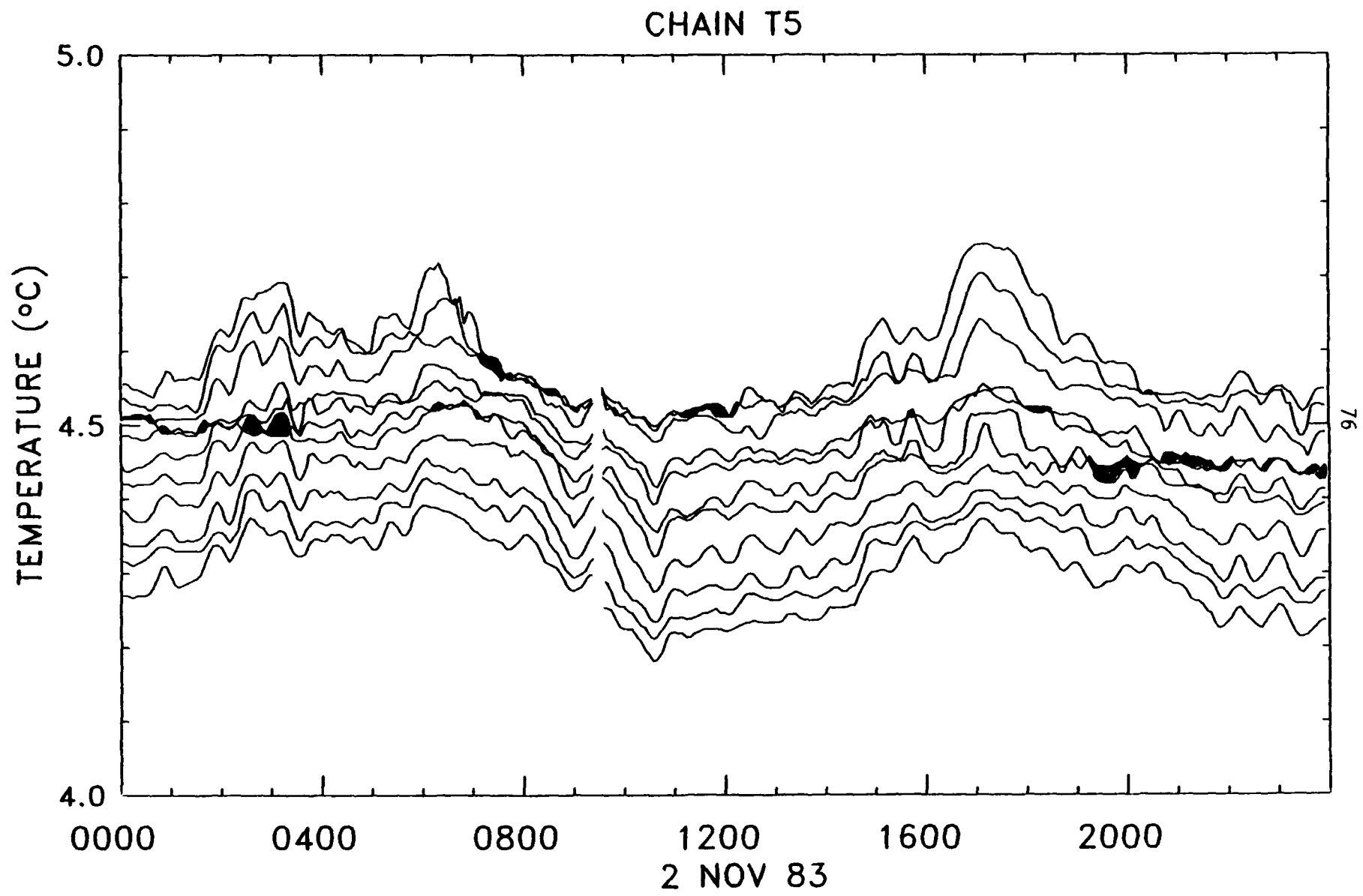
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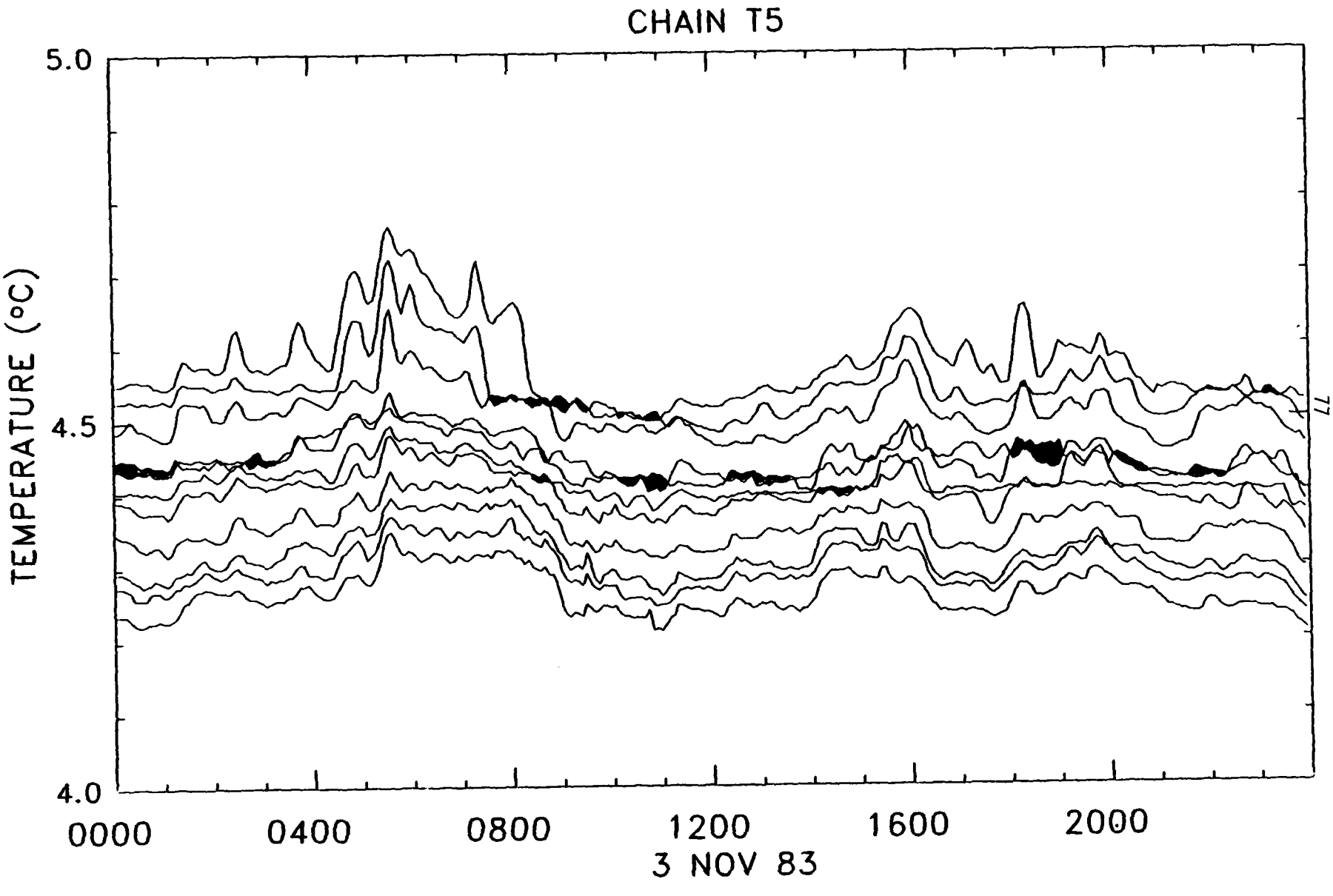
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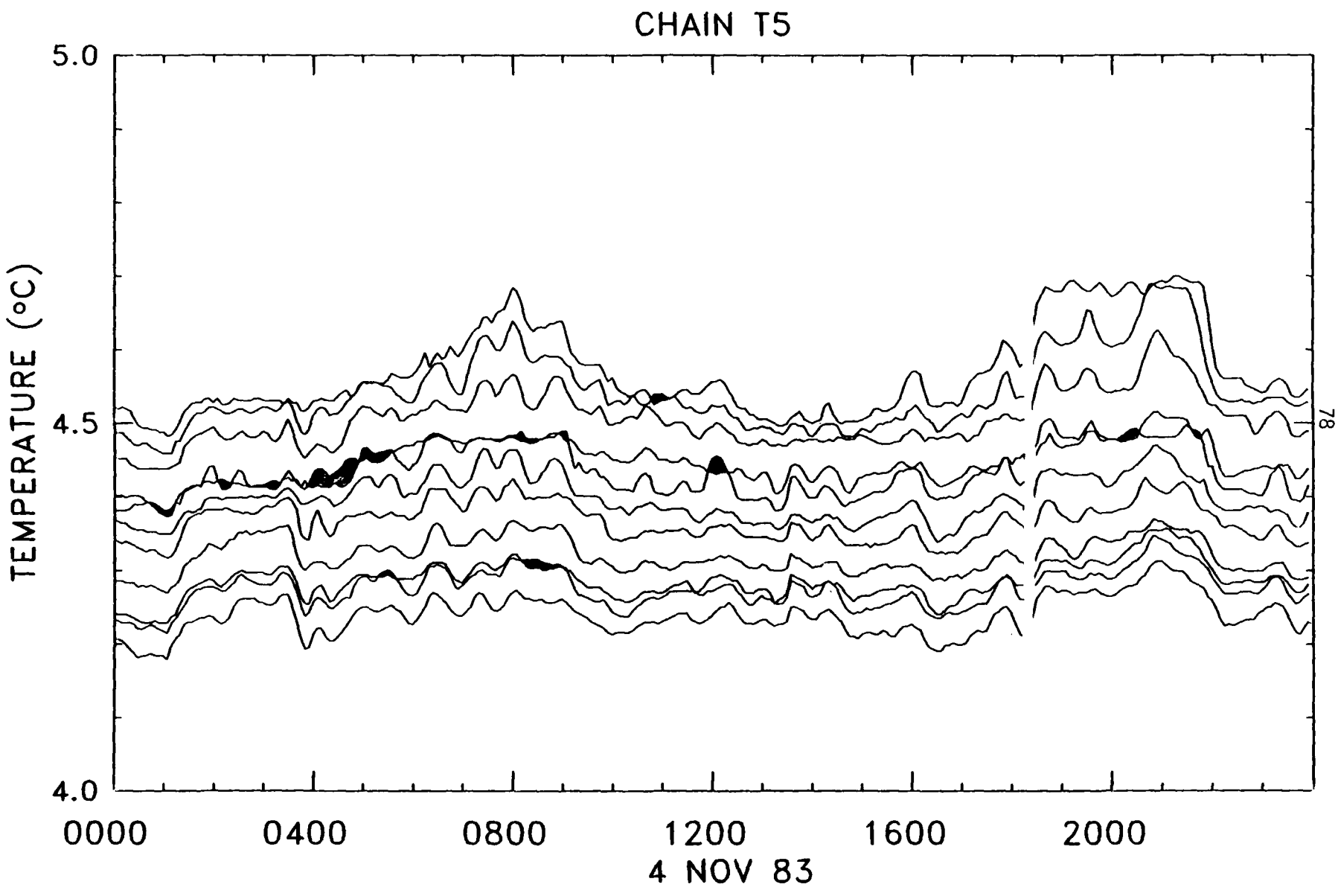
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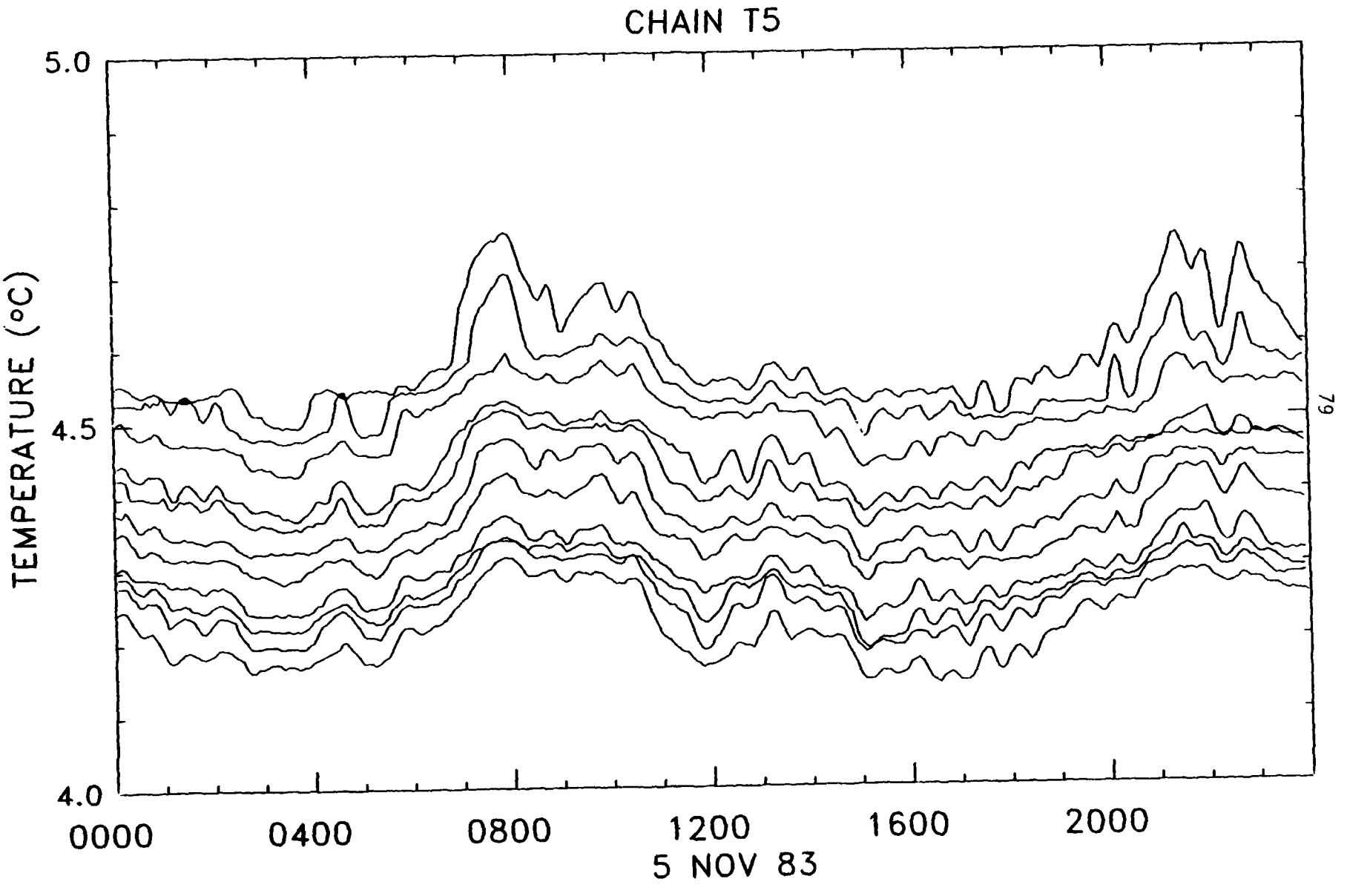
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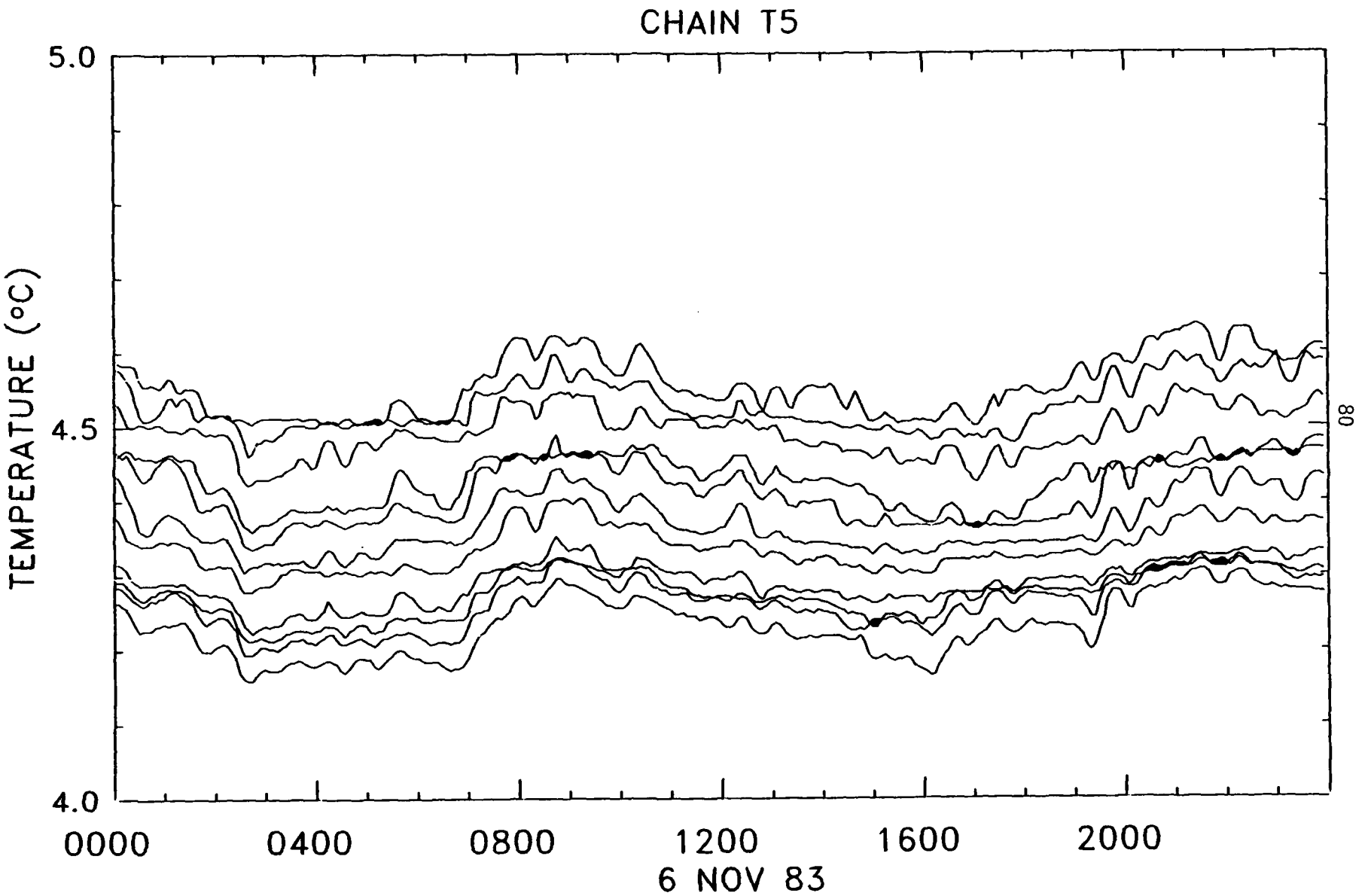
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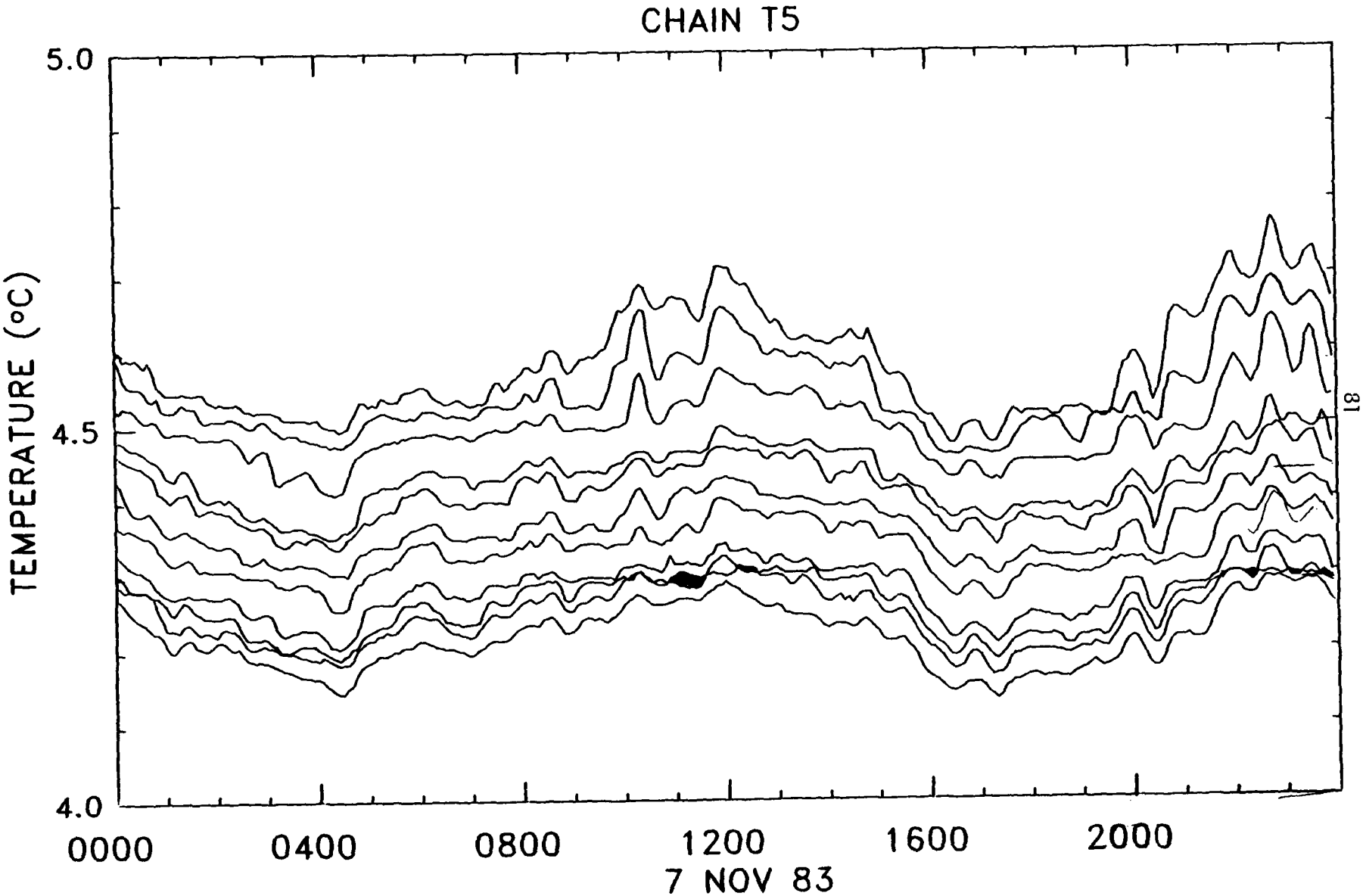
6 NOV 83
80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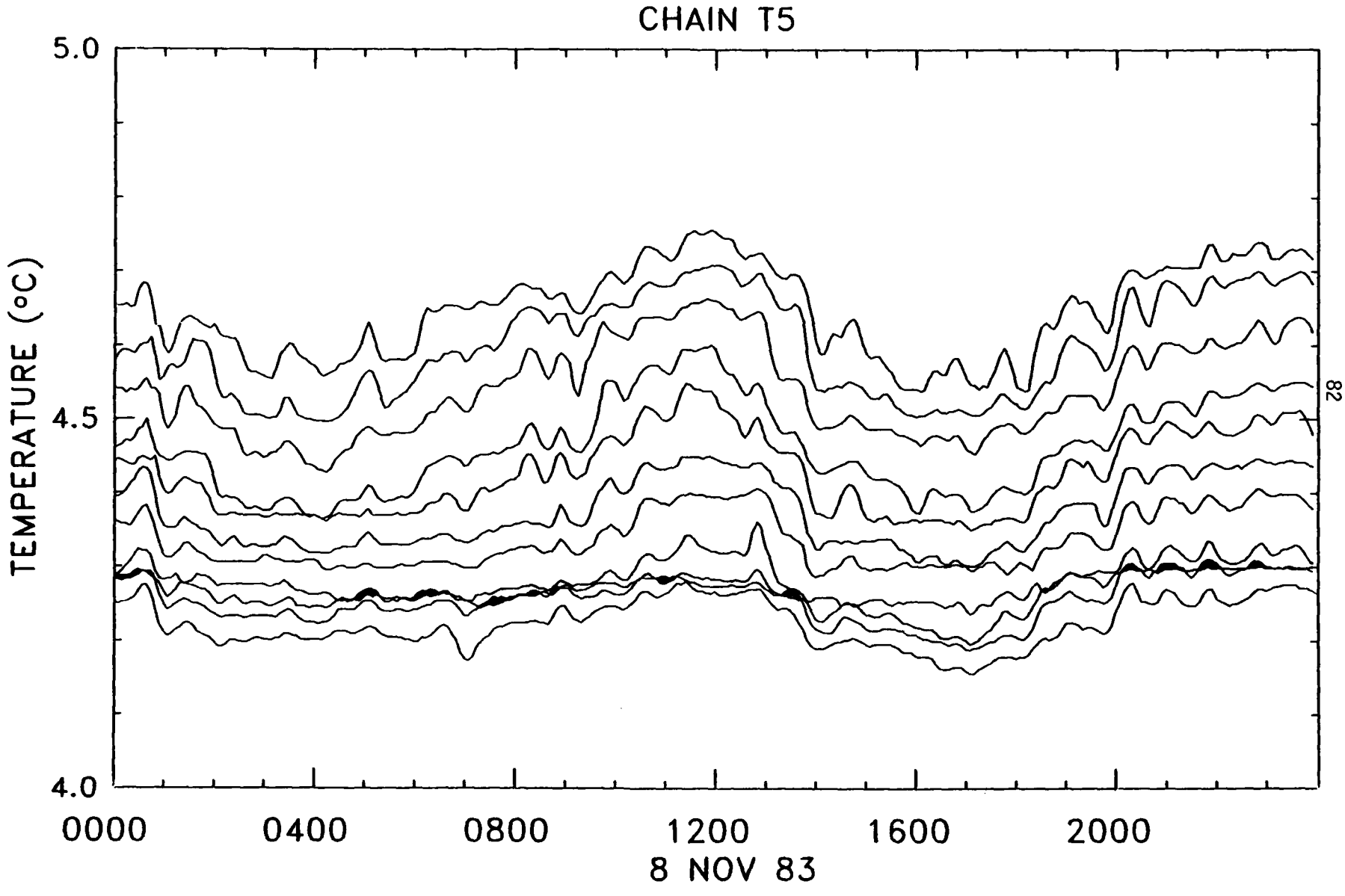
4.5
4.0
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
7 NOV 83
81


CHAIN T5
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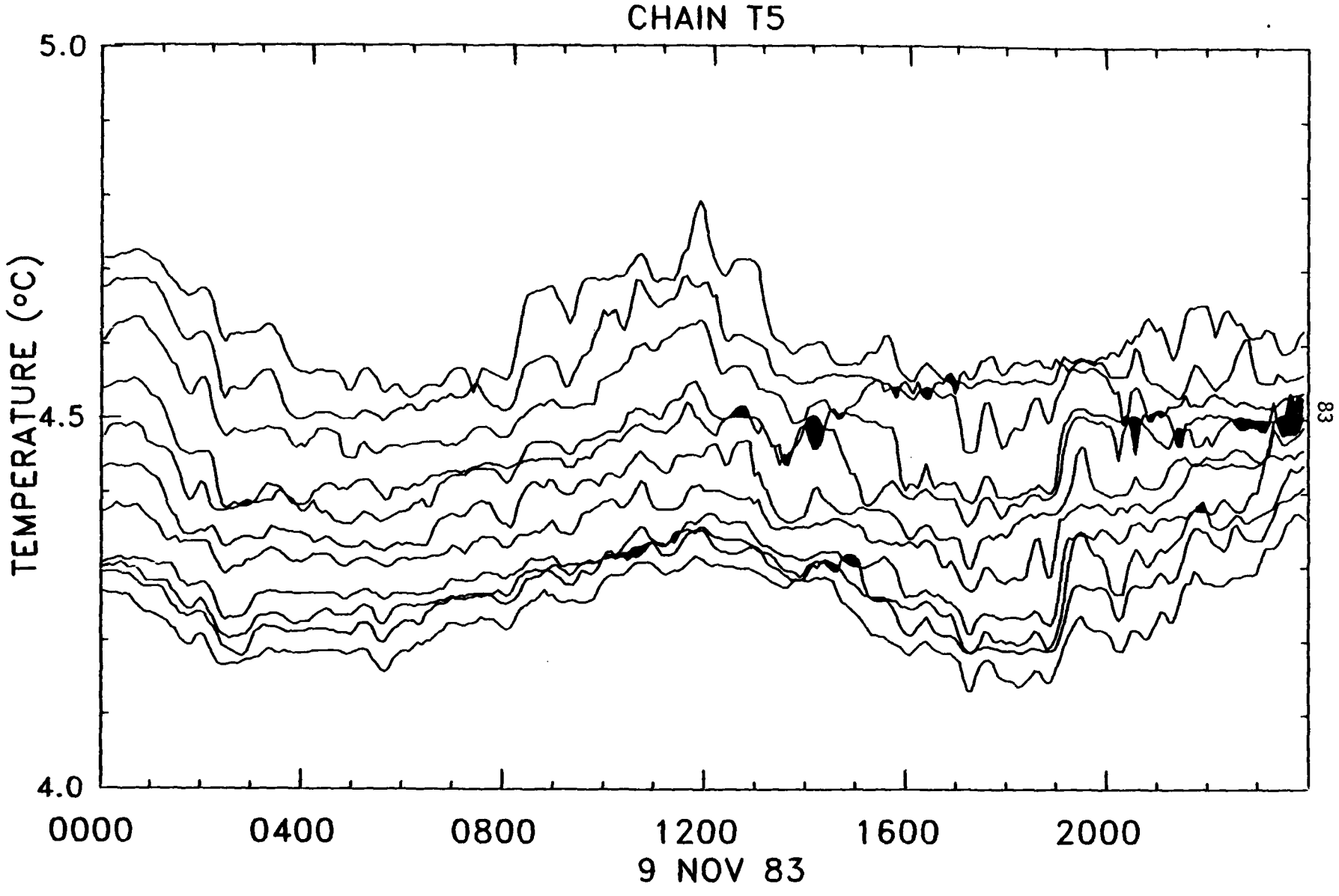
4.5
4.0
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
8 NOV 83
82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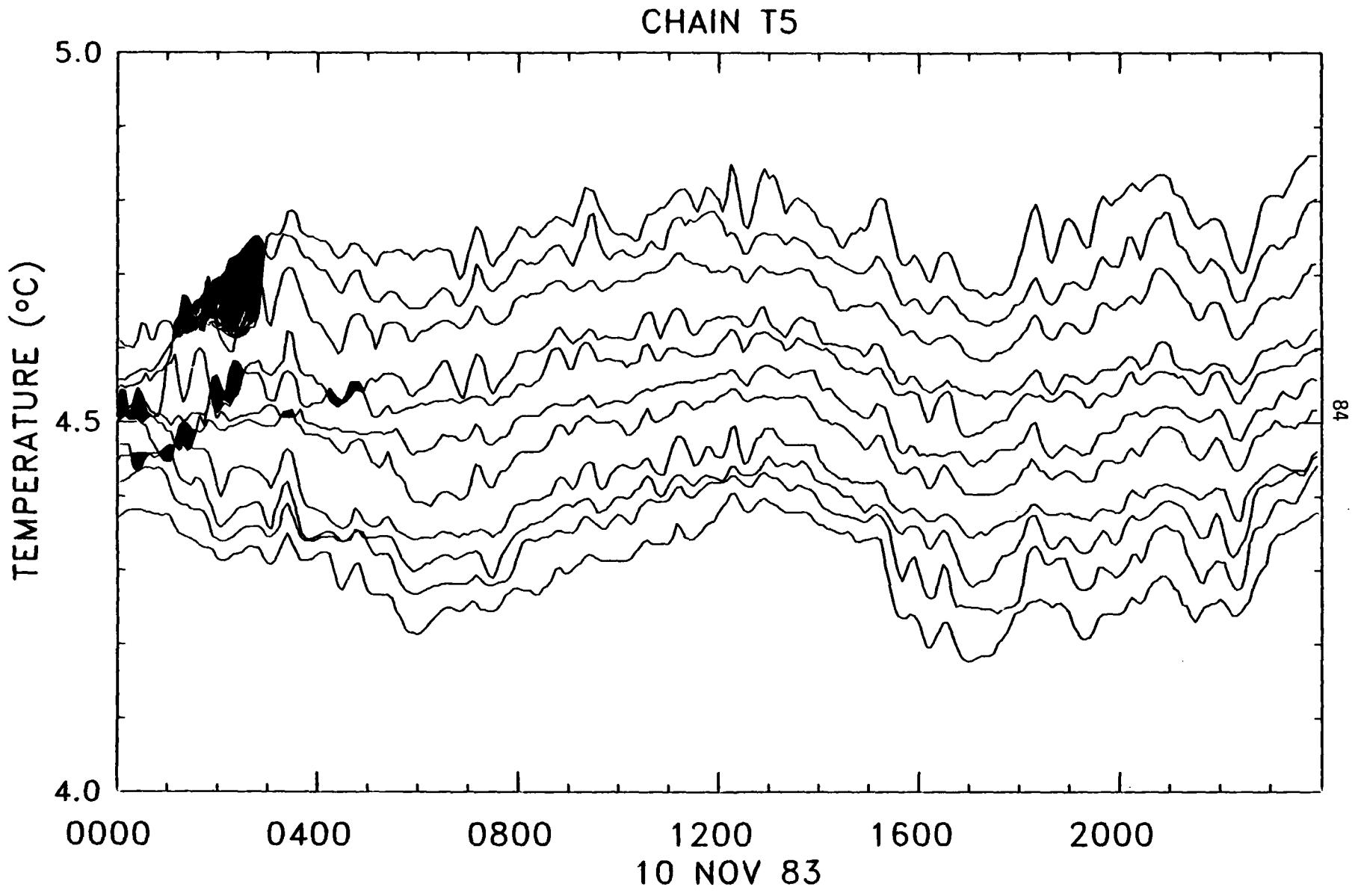
4.0
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
9 NOV 83
83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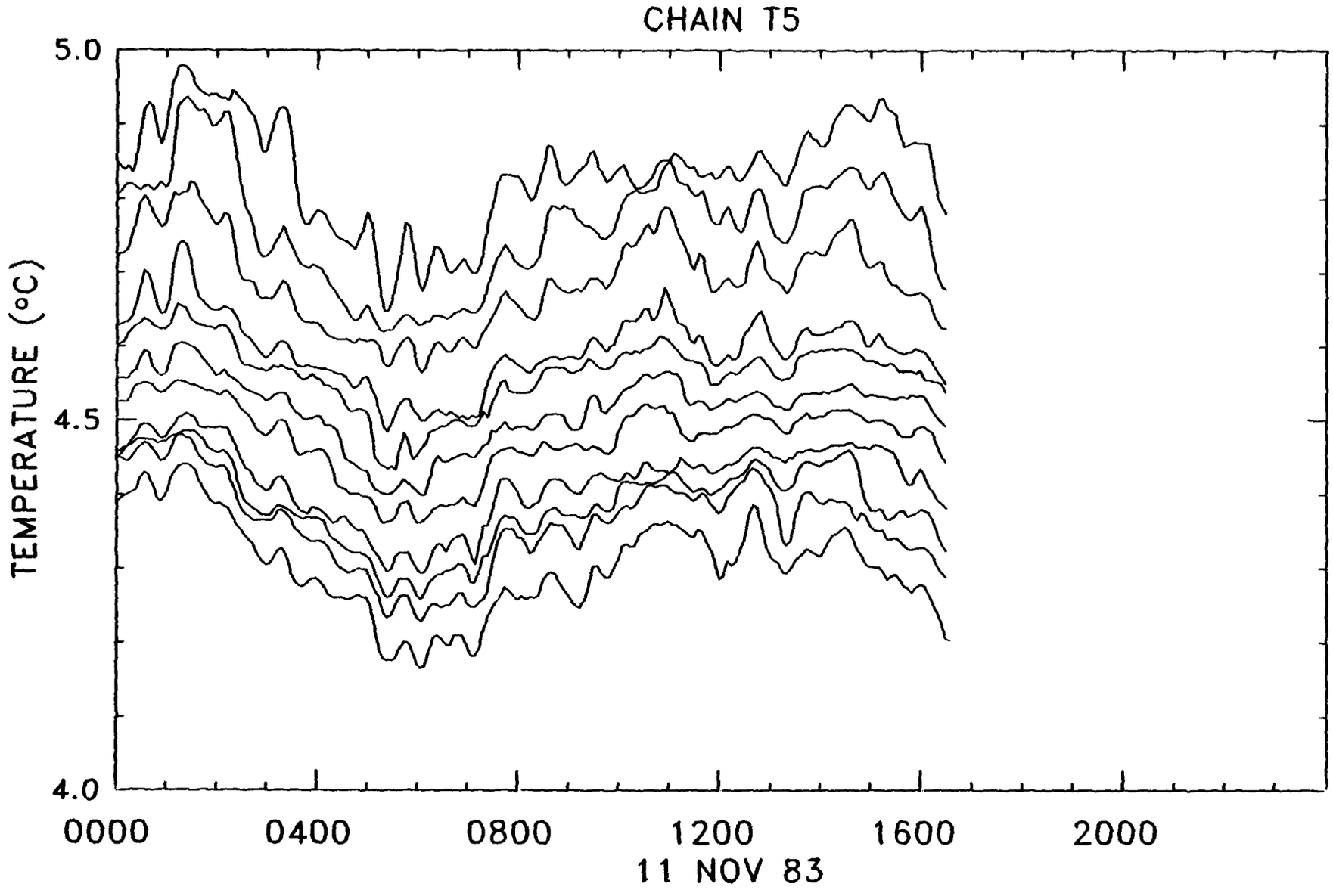
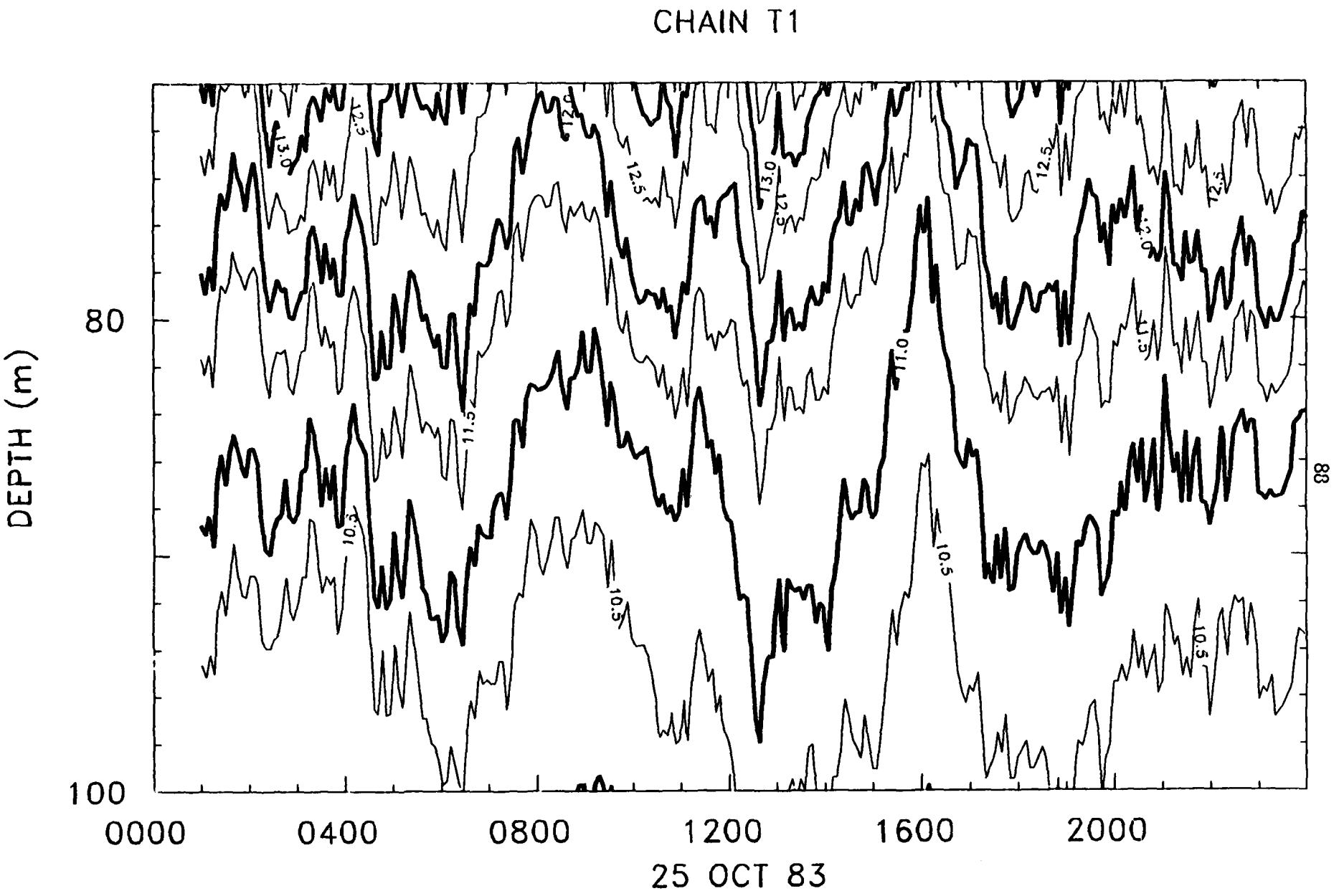
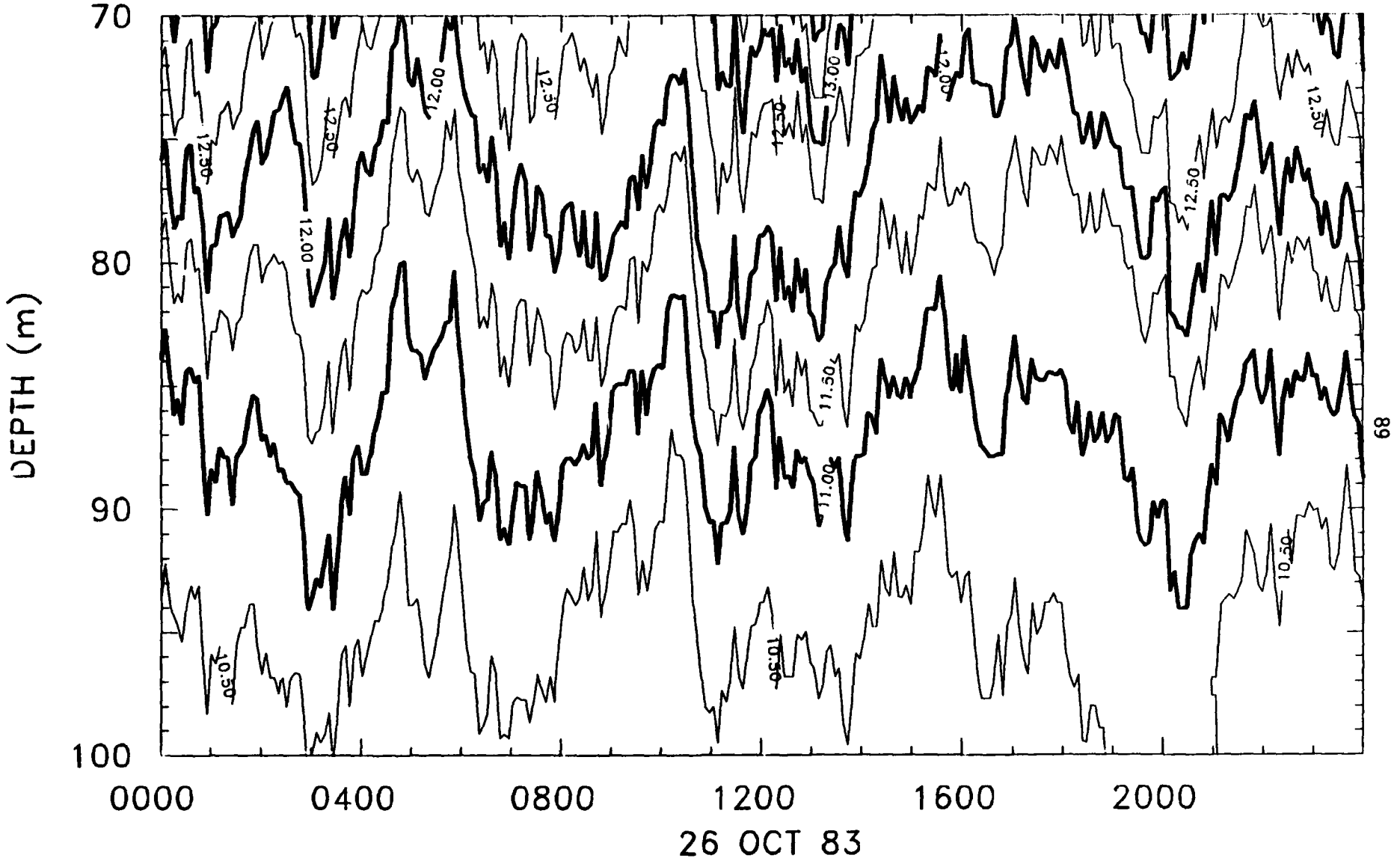
4.5
4.0
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
10 NOV 83
84


CHAIN T5
5.0
4.5
4.0
TEMPERATURE (°C)
0000
0400
0800
1200
1600
2000
11 NOV 83
85

TIME SERIES of ISOTHERM DEPTH

On the following pages are plots of the depth of selected isotherms as a function of time contoured objectively by computer. The data used are the same as those plotted in the previous section. For a given chain the contour intervals are evenly spaced, making it possible to tell visually when the vertical gradient is high or low. Some contours are plotted bold to aid in following features from one plot to the next.


CHAIN T1
DEPTH (m)
80
100
0000
0400
0800
1200
1600
2000
25 OCT 83
13.0
12.5
12.0
11.5
11.0
10.5
88


CHAIN T1
DEPTH (m)
70
80
90
100
0000
0400
0800
1200
1600
2000
26 OCT 83
12.50
12.00
12.50
12.00
12.50
13.00
12.50
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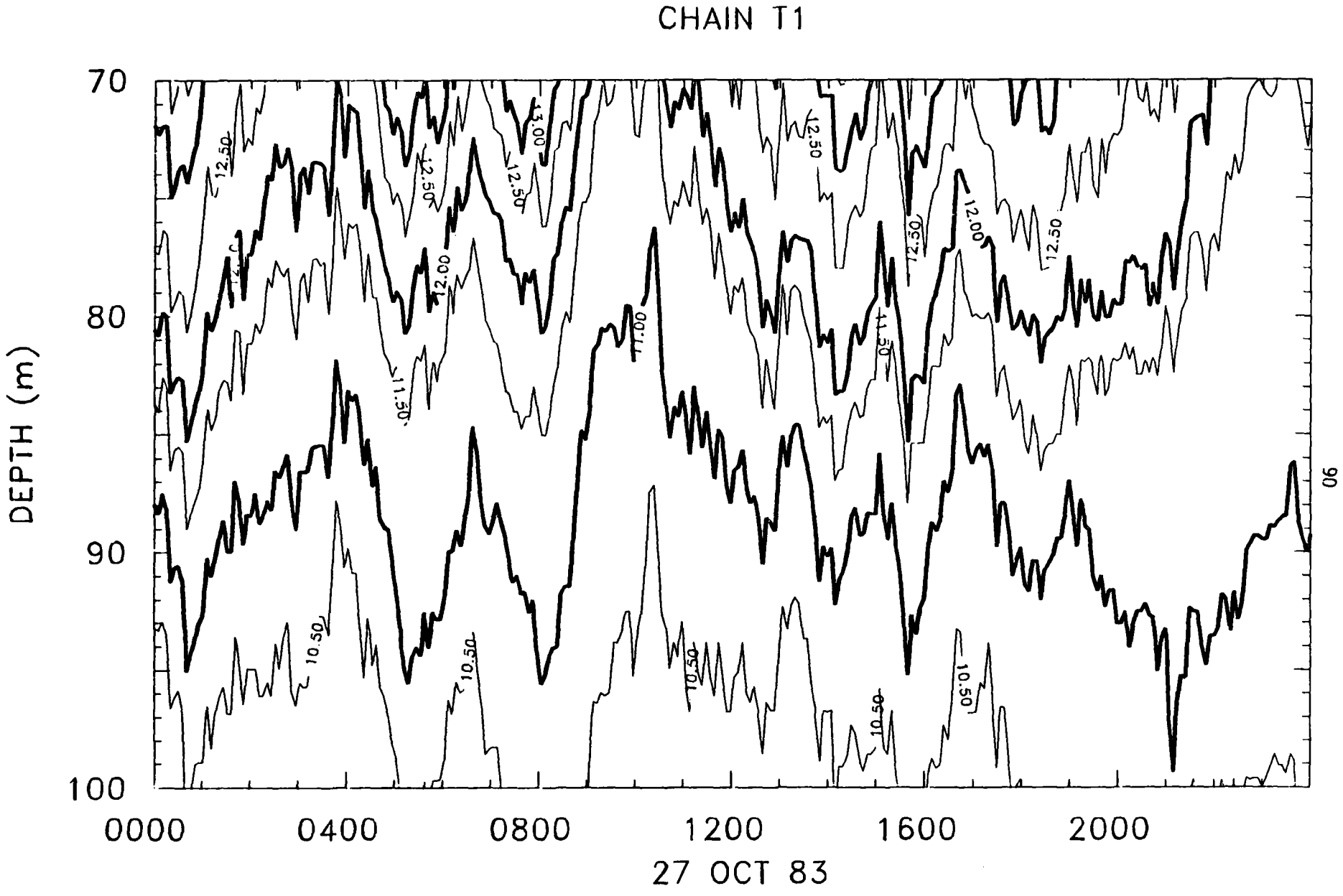
12.50
11.50
11.00
10.50
10.50
68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DEPTH (m)
70
80
90
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0800
1200
1600
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27 OCT 83
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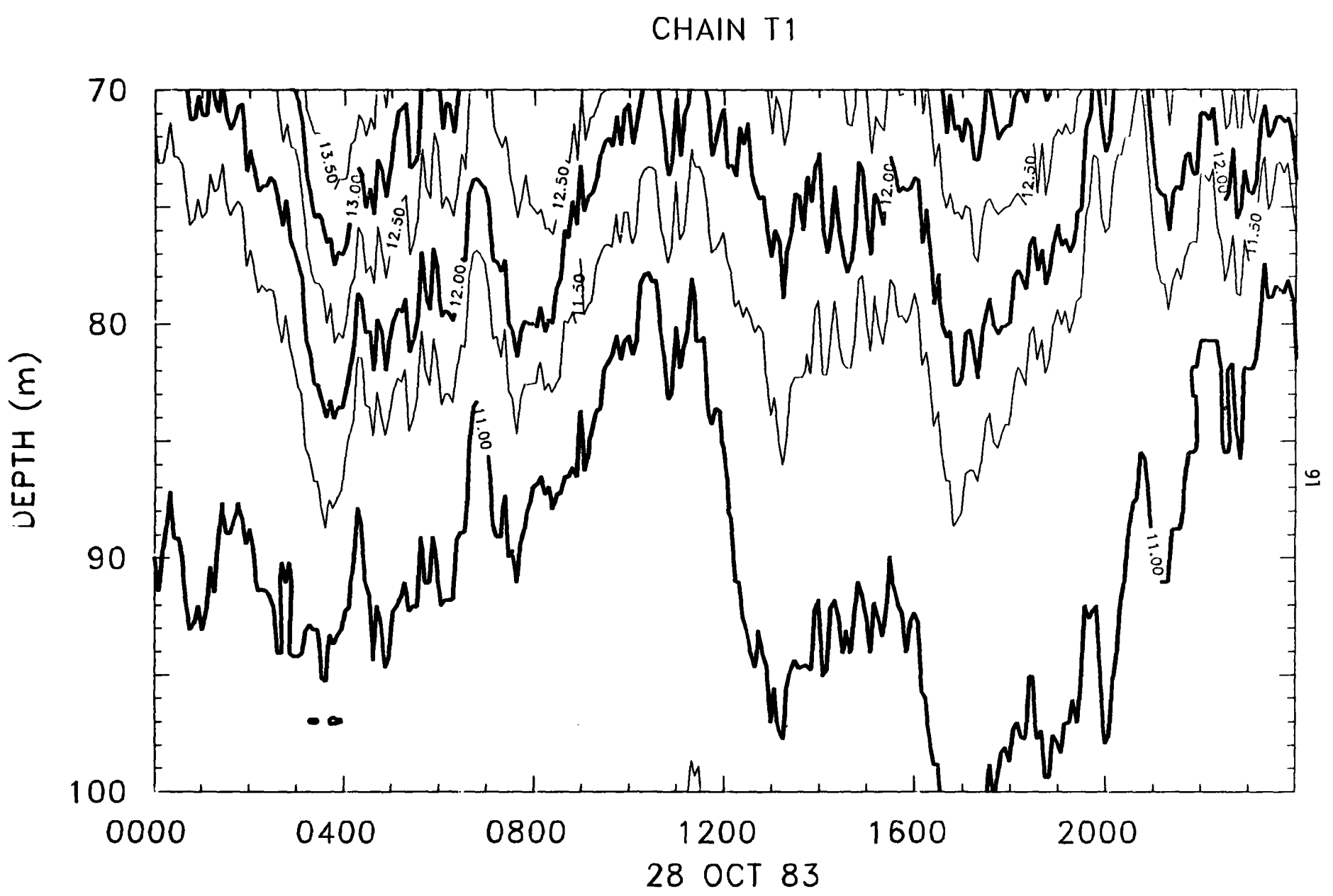
12.00
11.50
11.00
10.50
90


CHAIN T1
DEPTH (m)
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80
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0400
0800
1200
1600
2000
28 OCT 83
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12.50
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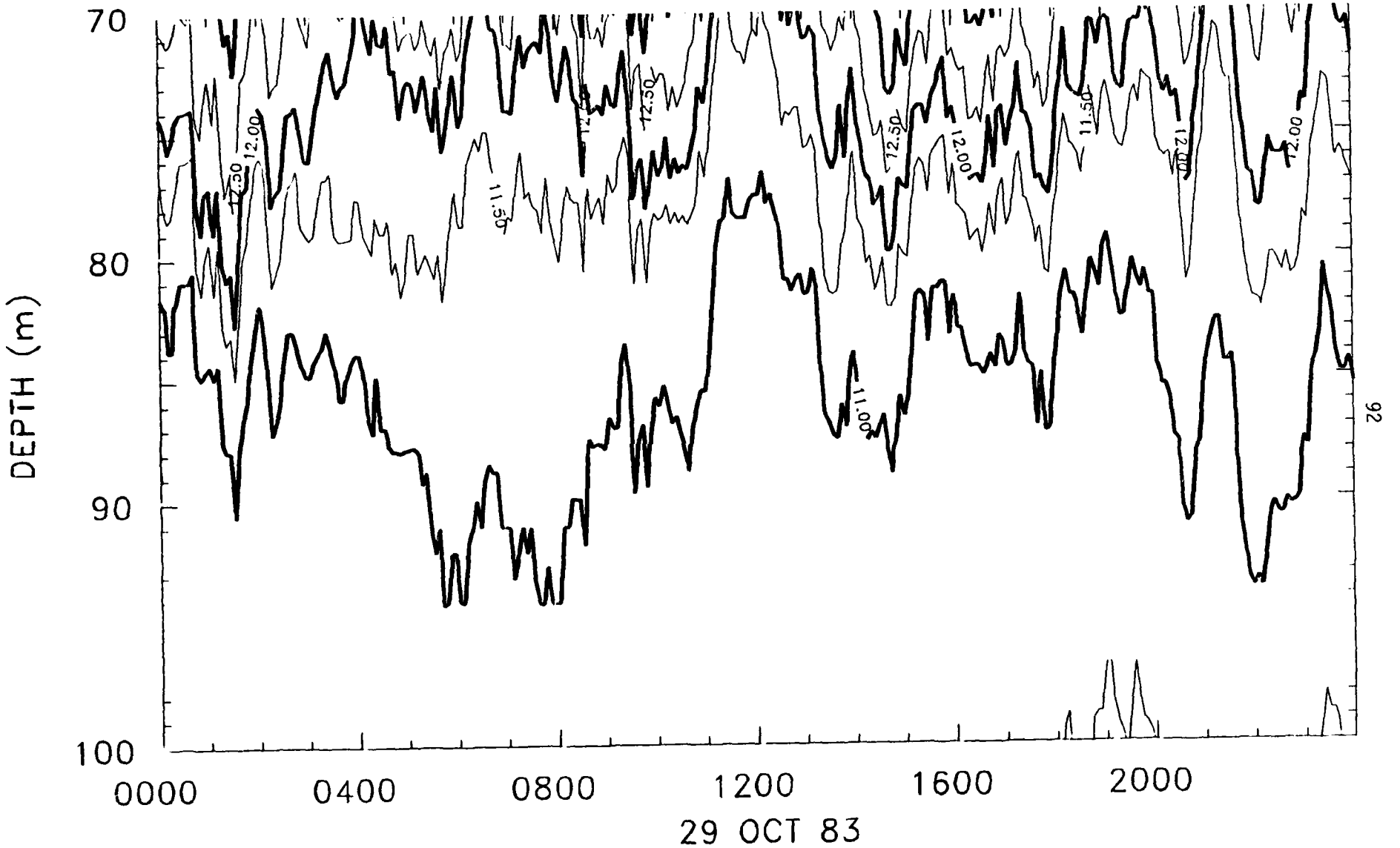
11.50
11.00
91


CHAIN T1
DEPTH (m)
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80
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100
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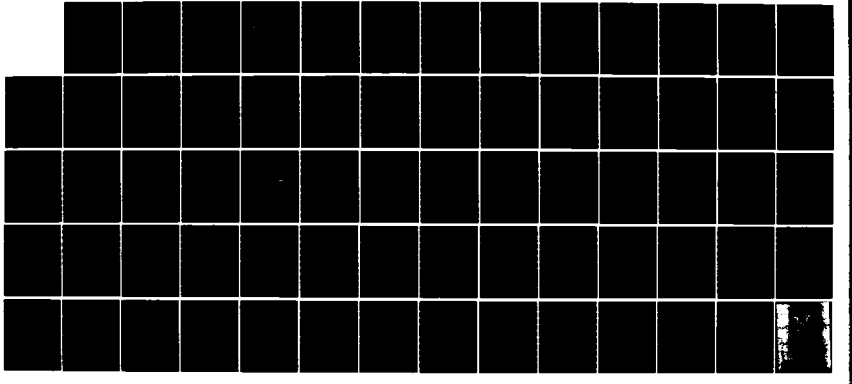
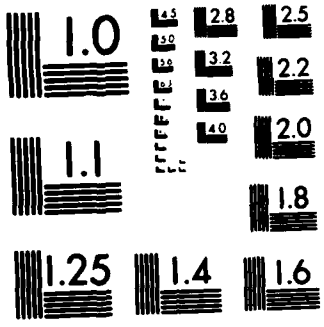
0400
0800
1200
1600
2000
29 OCT 83
12.00
12.50
11.50
11.00
92

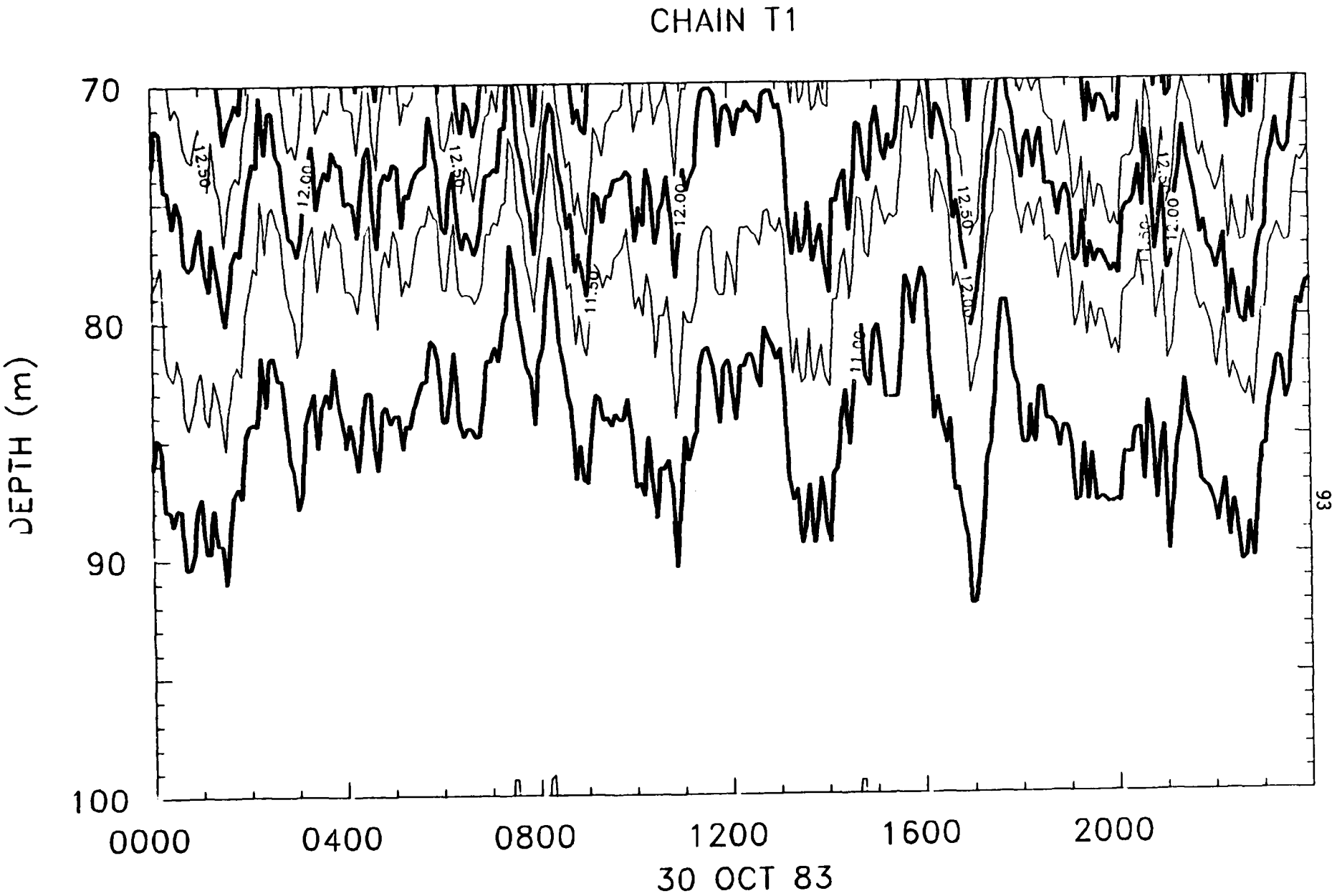
AD-A143 933 THERMISTOR CHAIN OBSERVATIONS DURING MILDEX (MIXED LAYER DYNAMICS EXPERIMENT)(U) OREGON STATE UNIV CORVALLIS COLL OF OCEANOGRAPHY M D LEVINE ET AL. 2/2

UNCLASSIFIED JUN 84 DATA-111 N00014-79-C-0004 F/G 8/10 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A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100
DEPTH (m)
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12.00
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93
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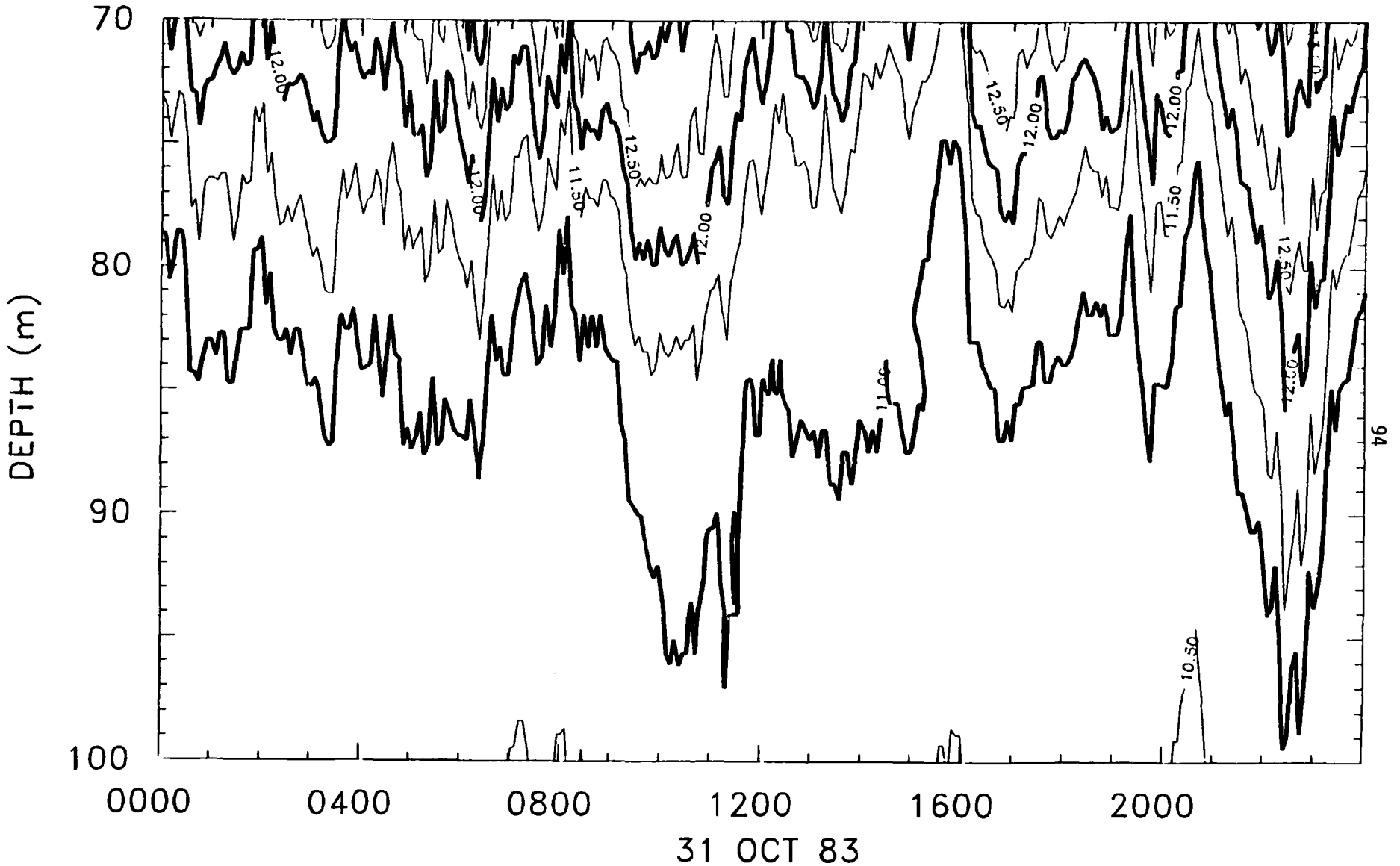
2000
30 OCT 83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100
DEPTH (m)
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2000
31 OCT 83
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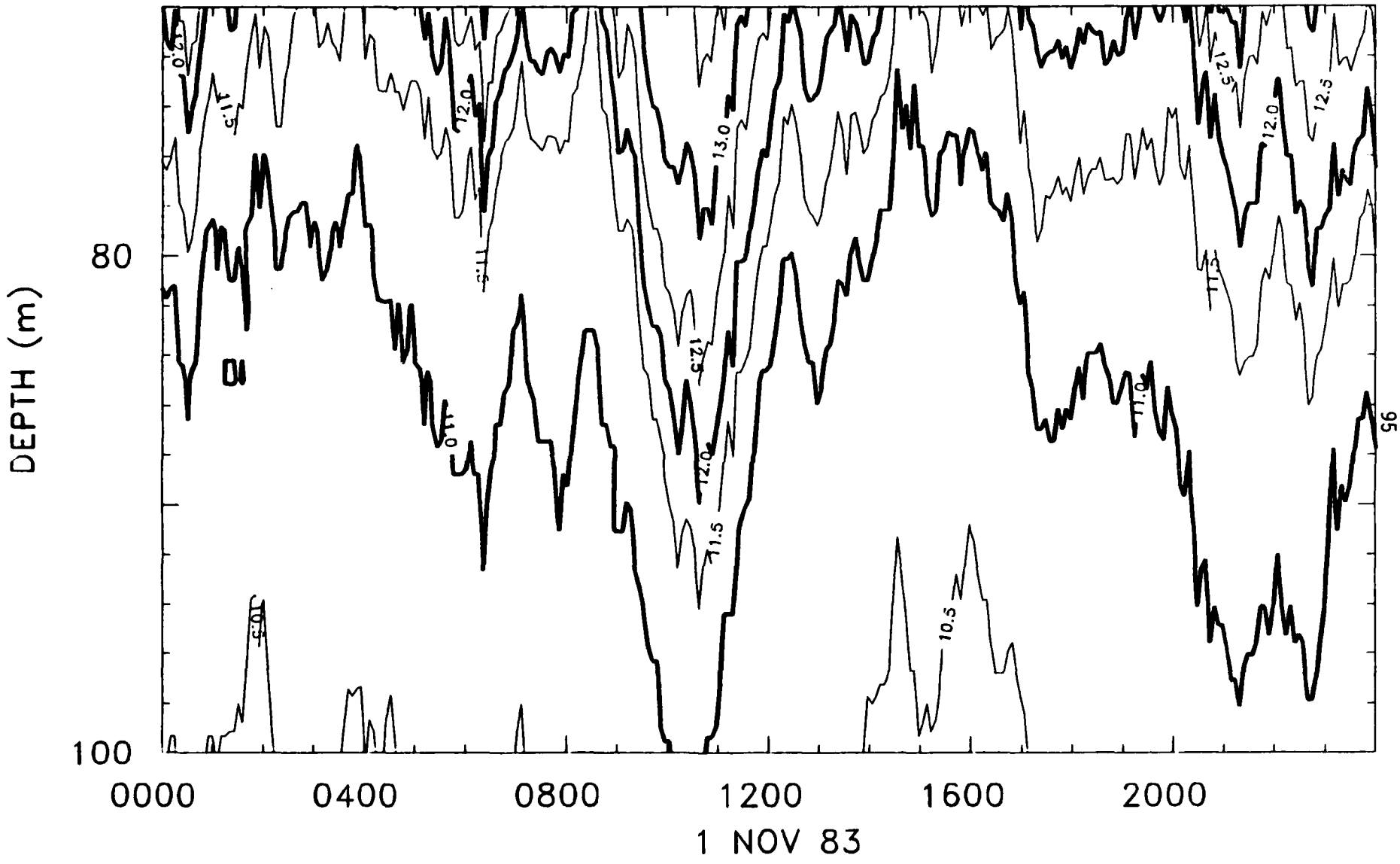
12.50
12.00
11.50
10.50
94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DEPTH (m)
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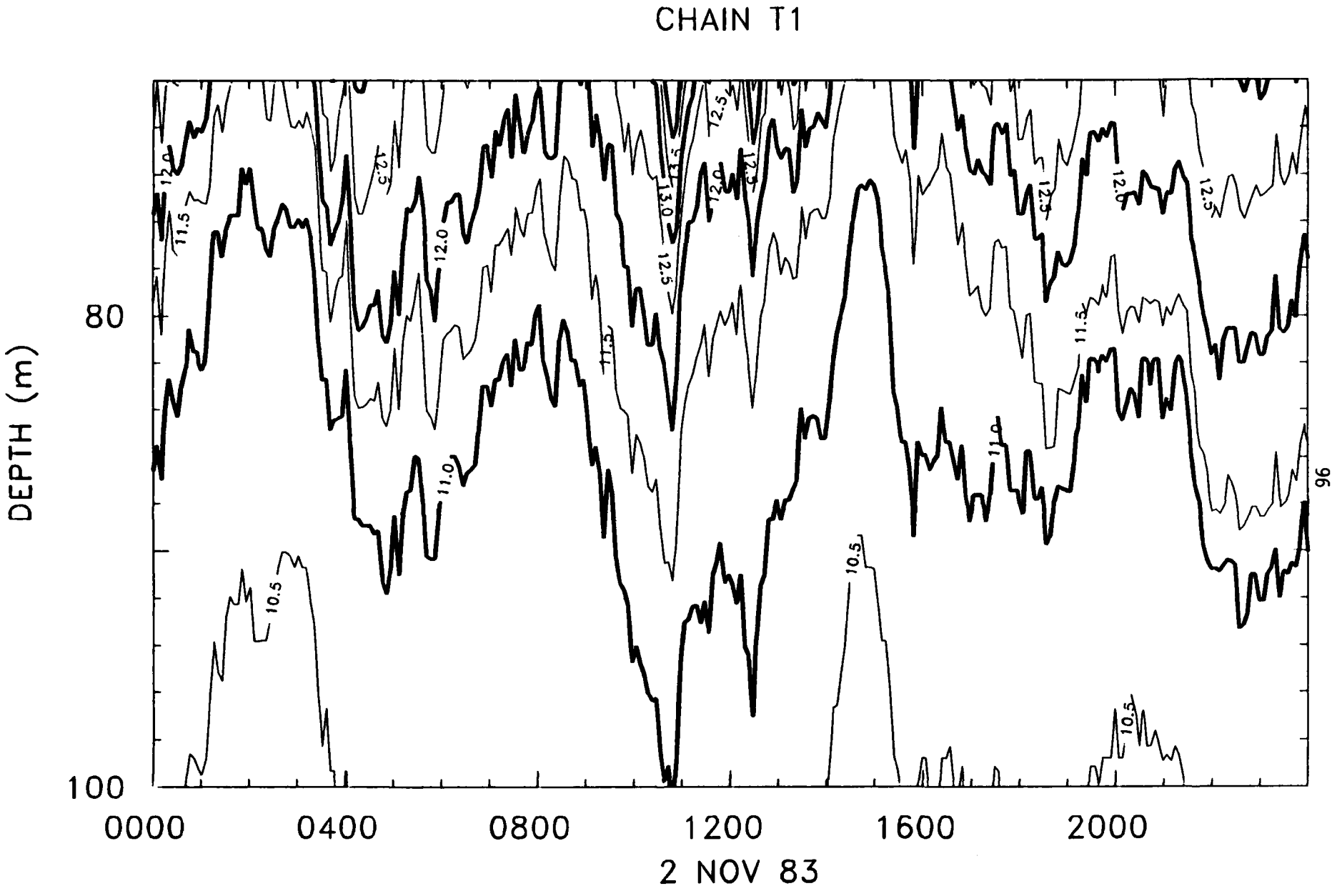
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DEPTH (m)
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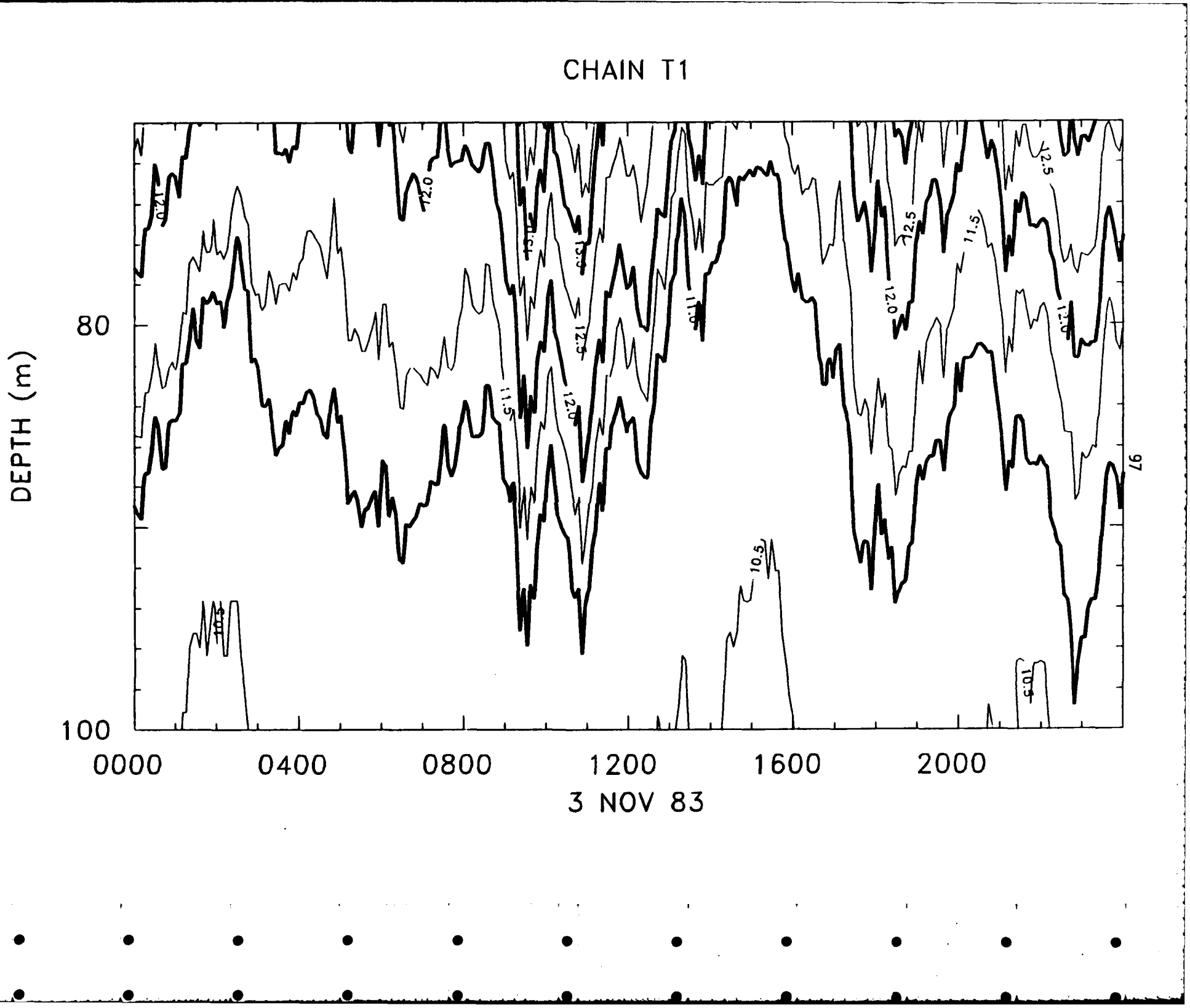
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DEPTH (m)
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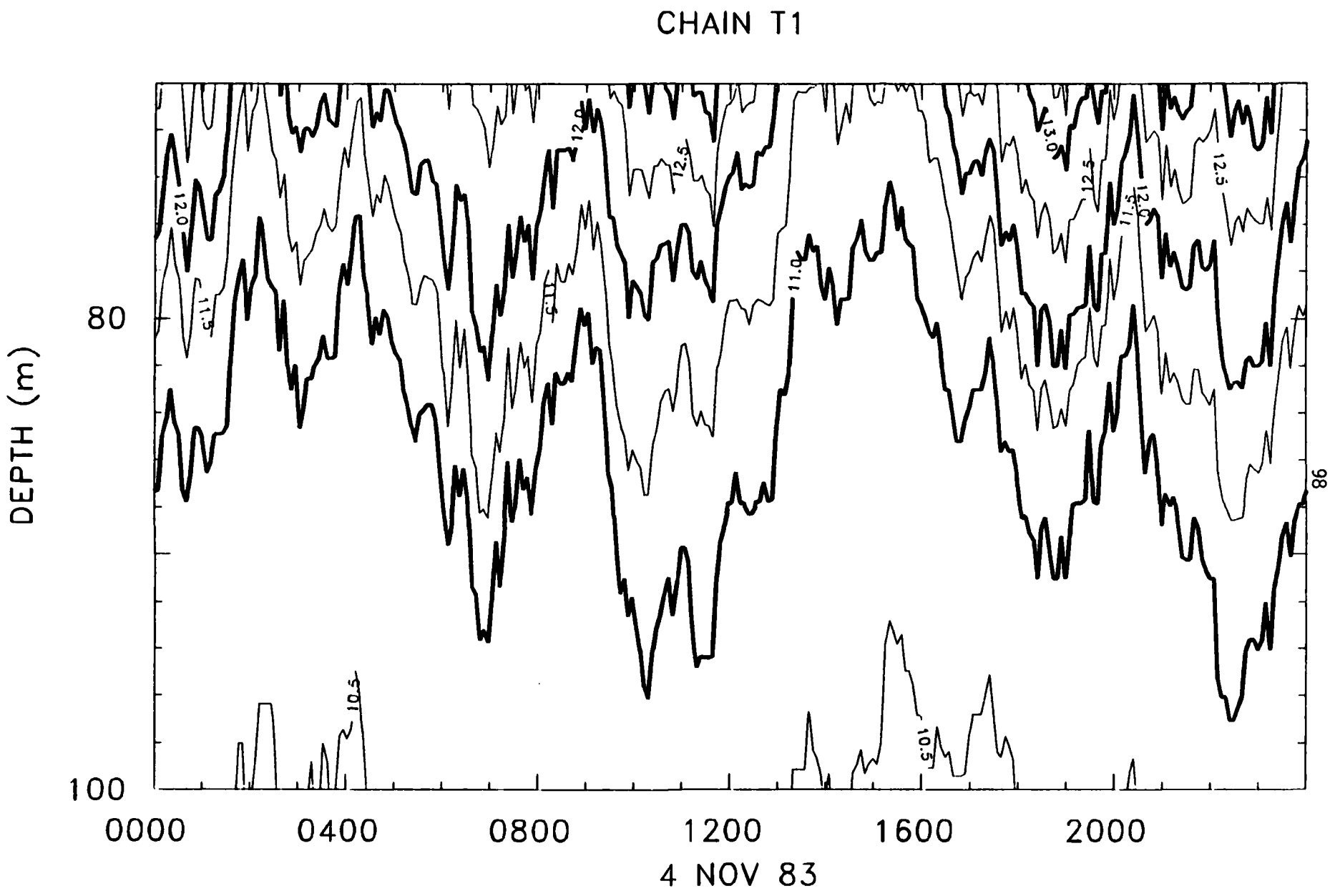
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DEPTH (m)
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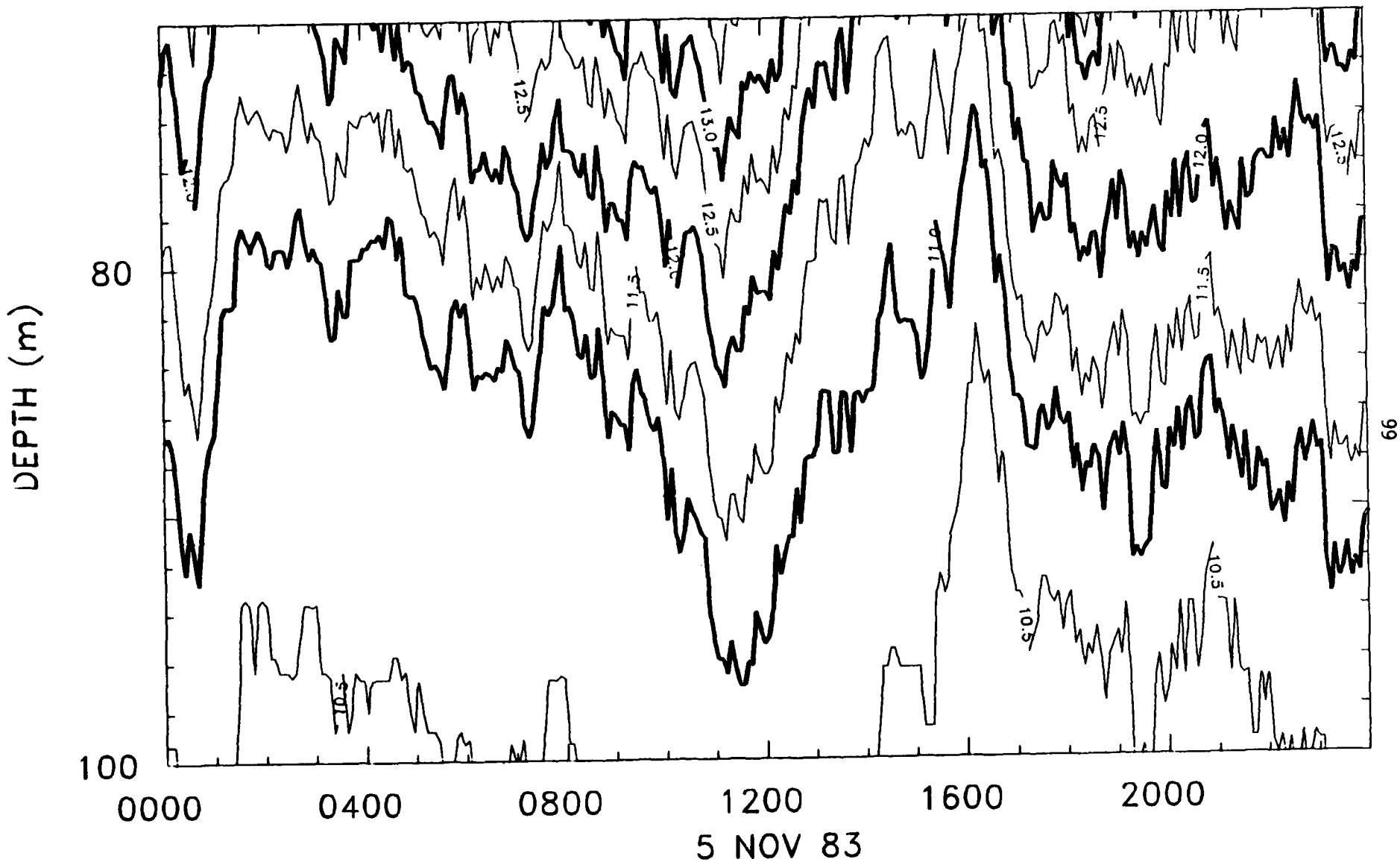
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5 NOV 83
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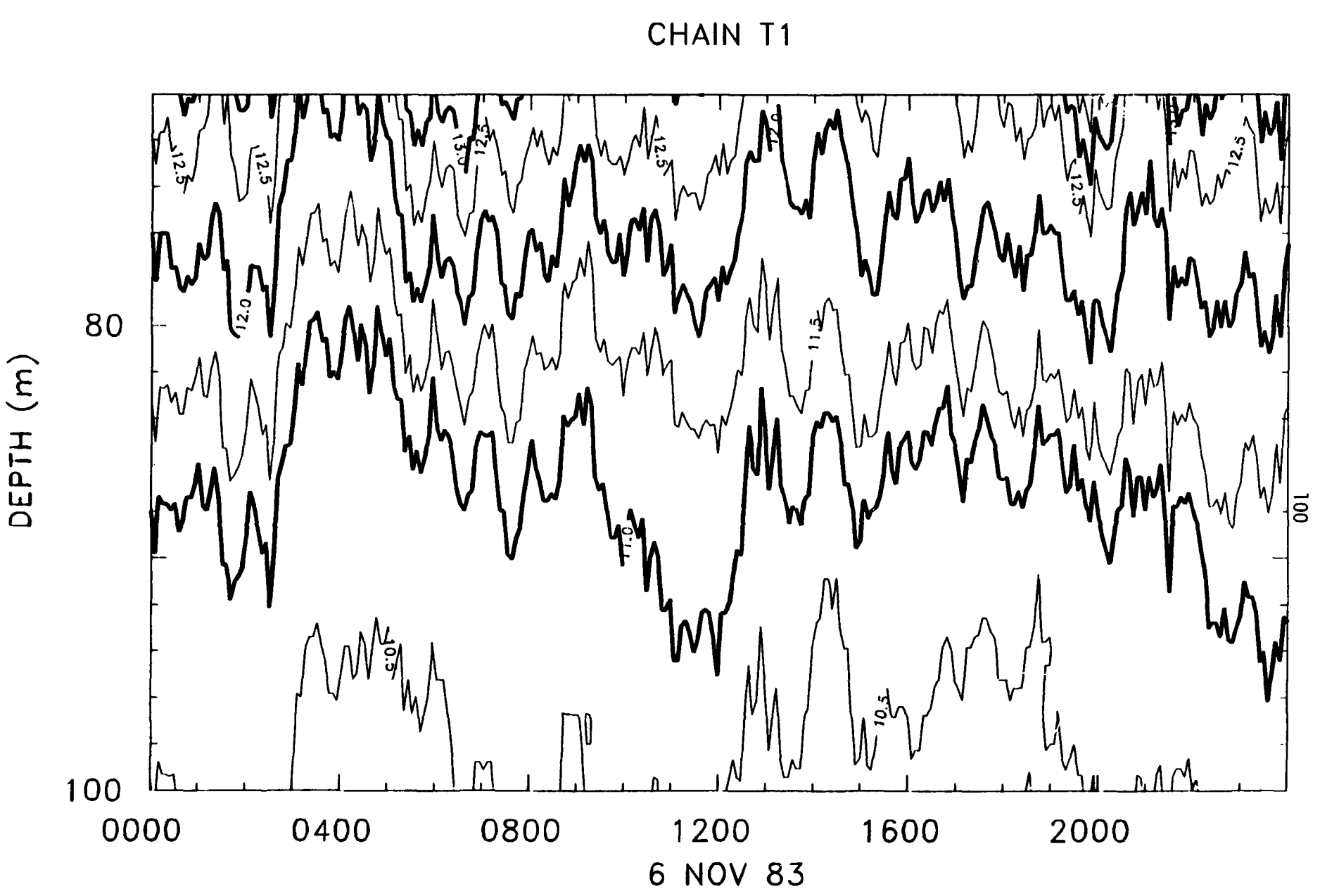
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1600
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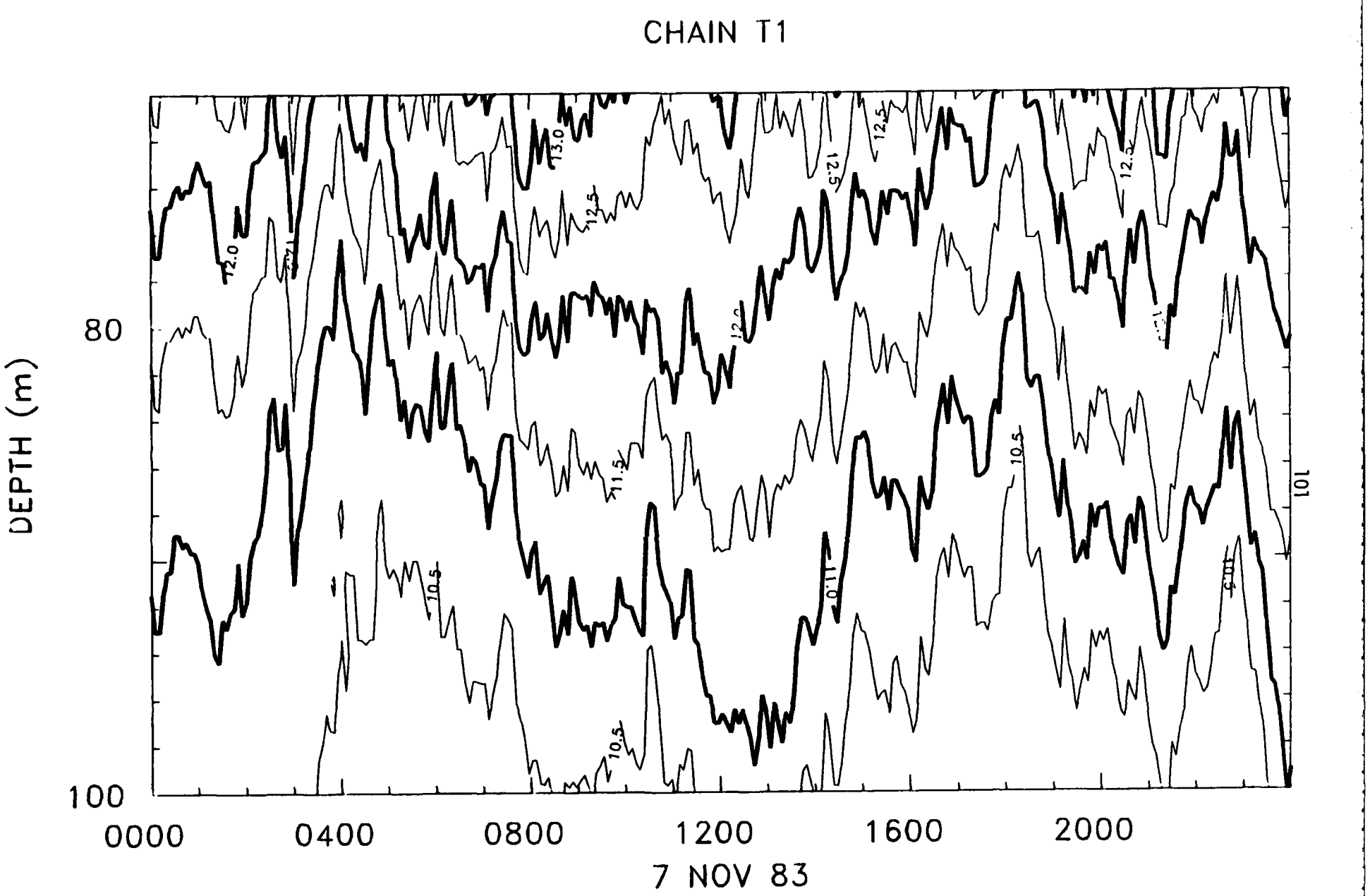
6 NOV 83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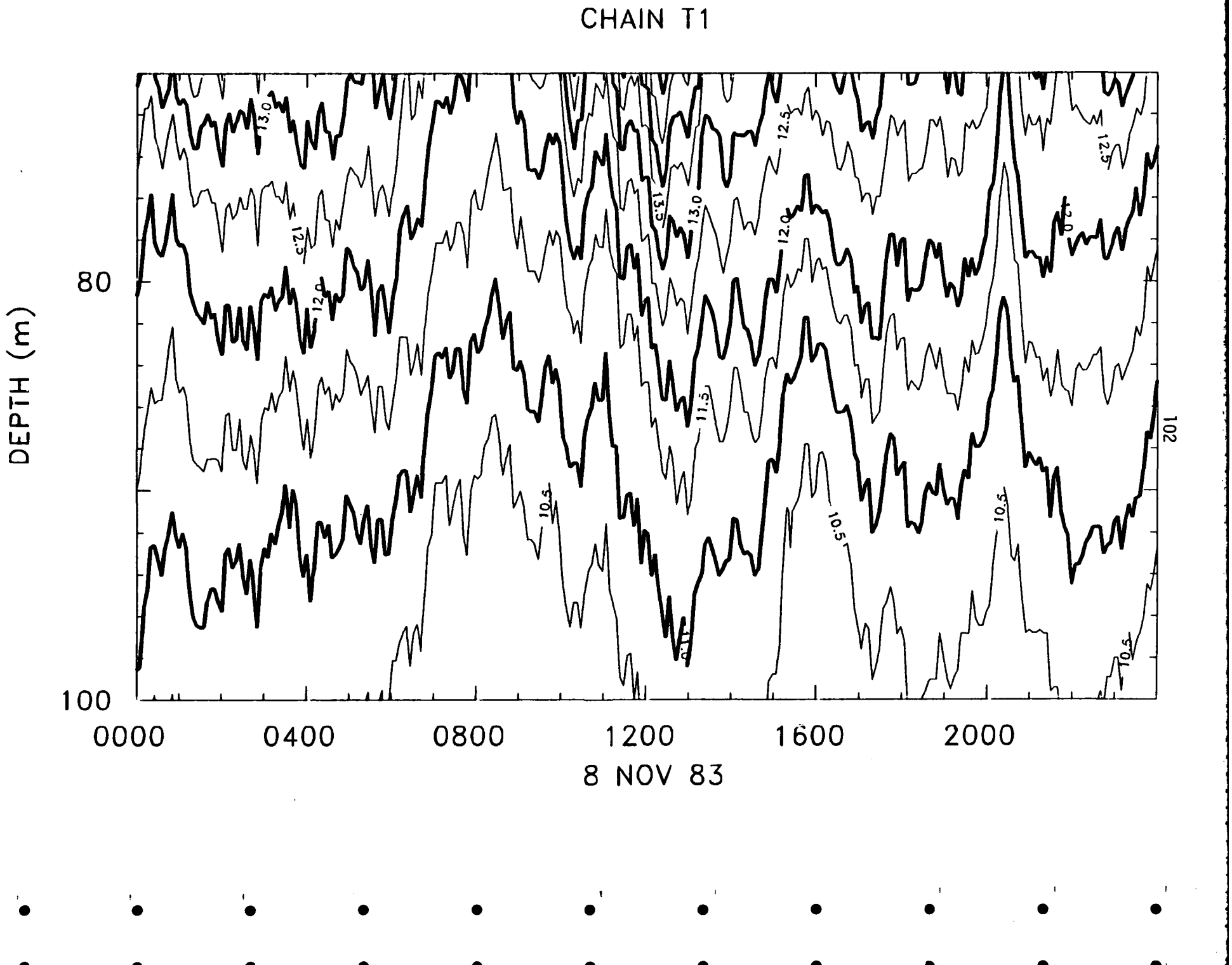
7 NOV 83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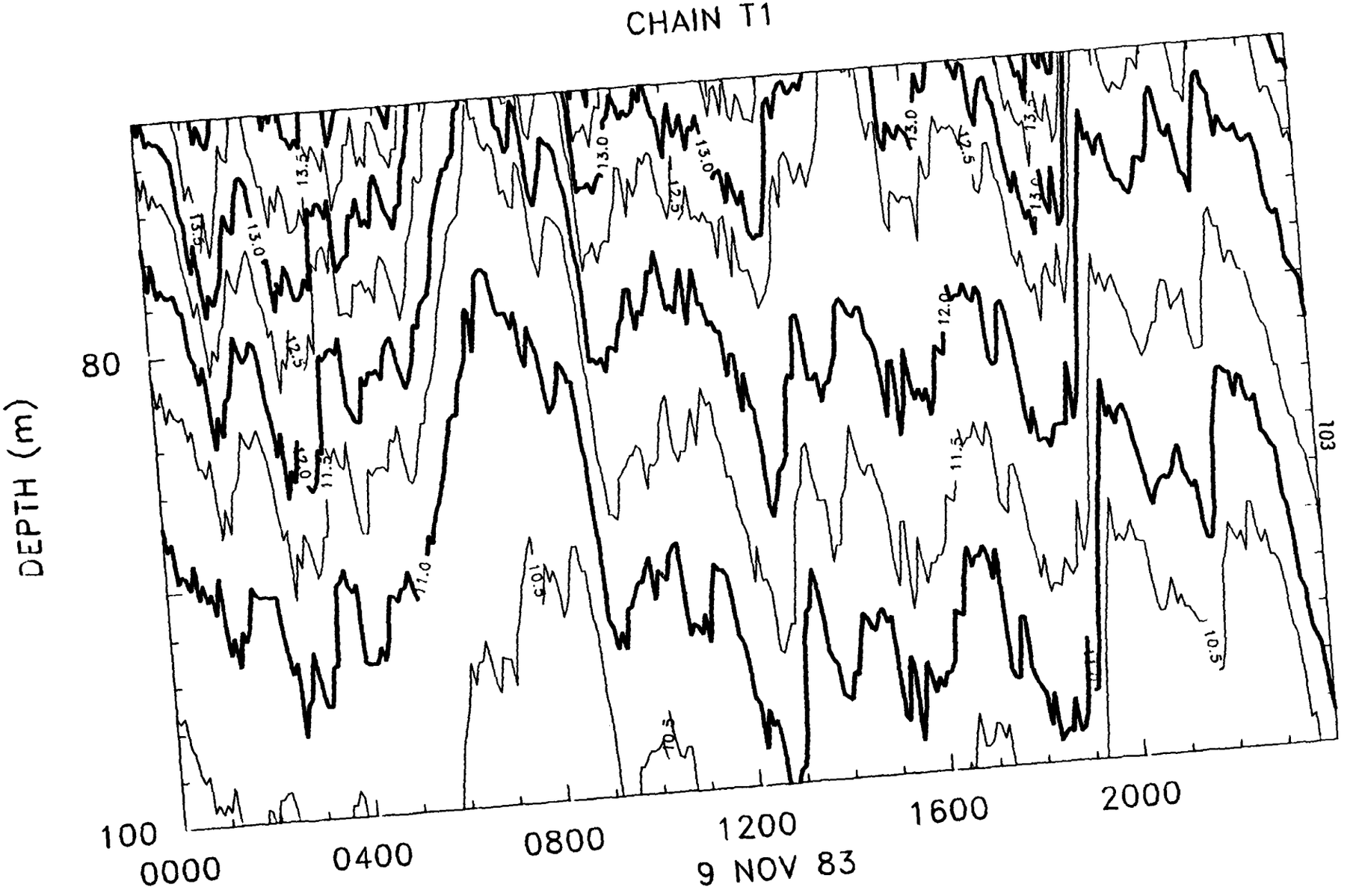
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DEPTH (m)
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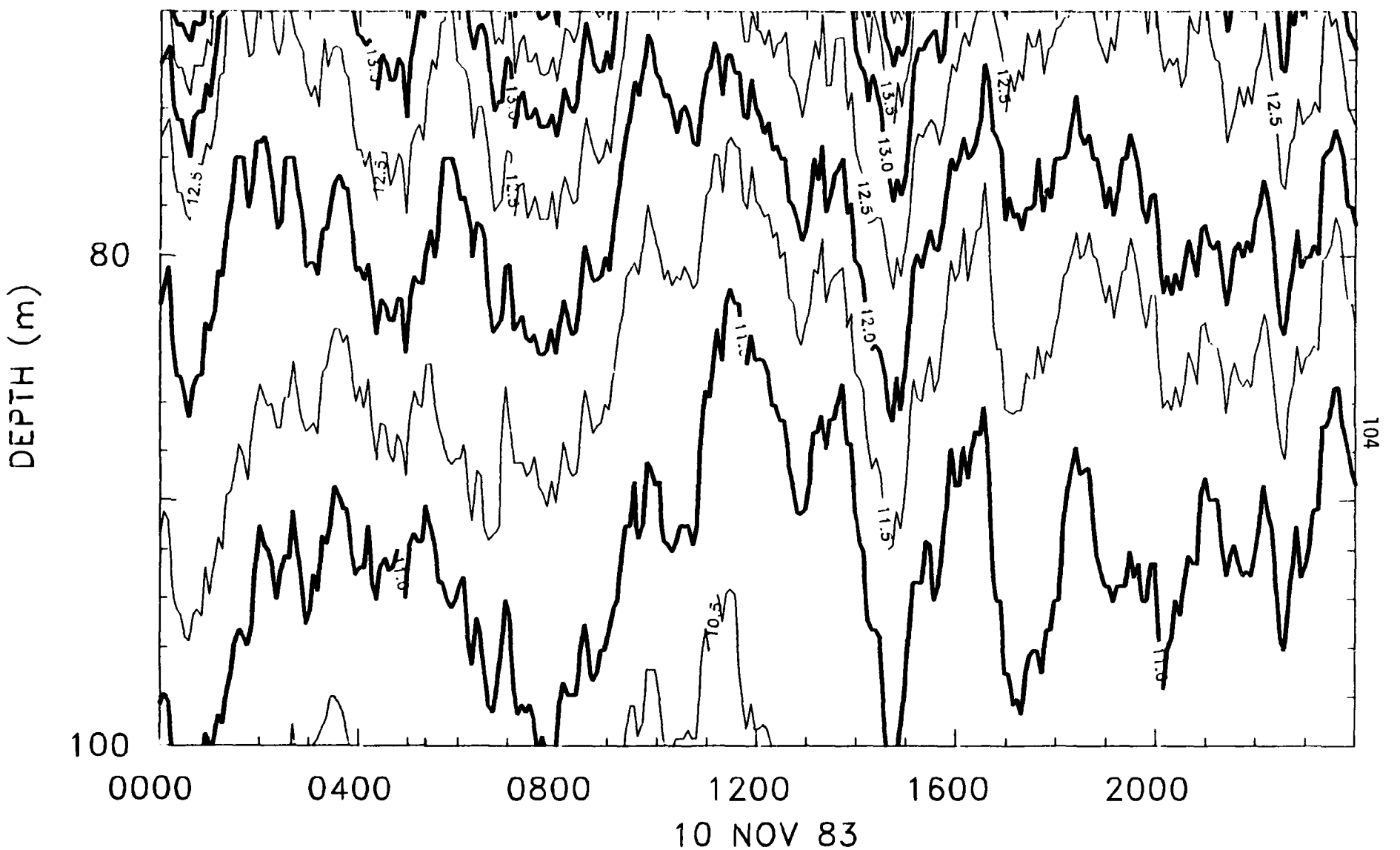
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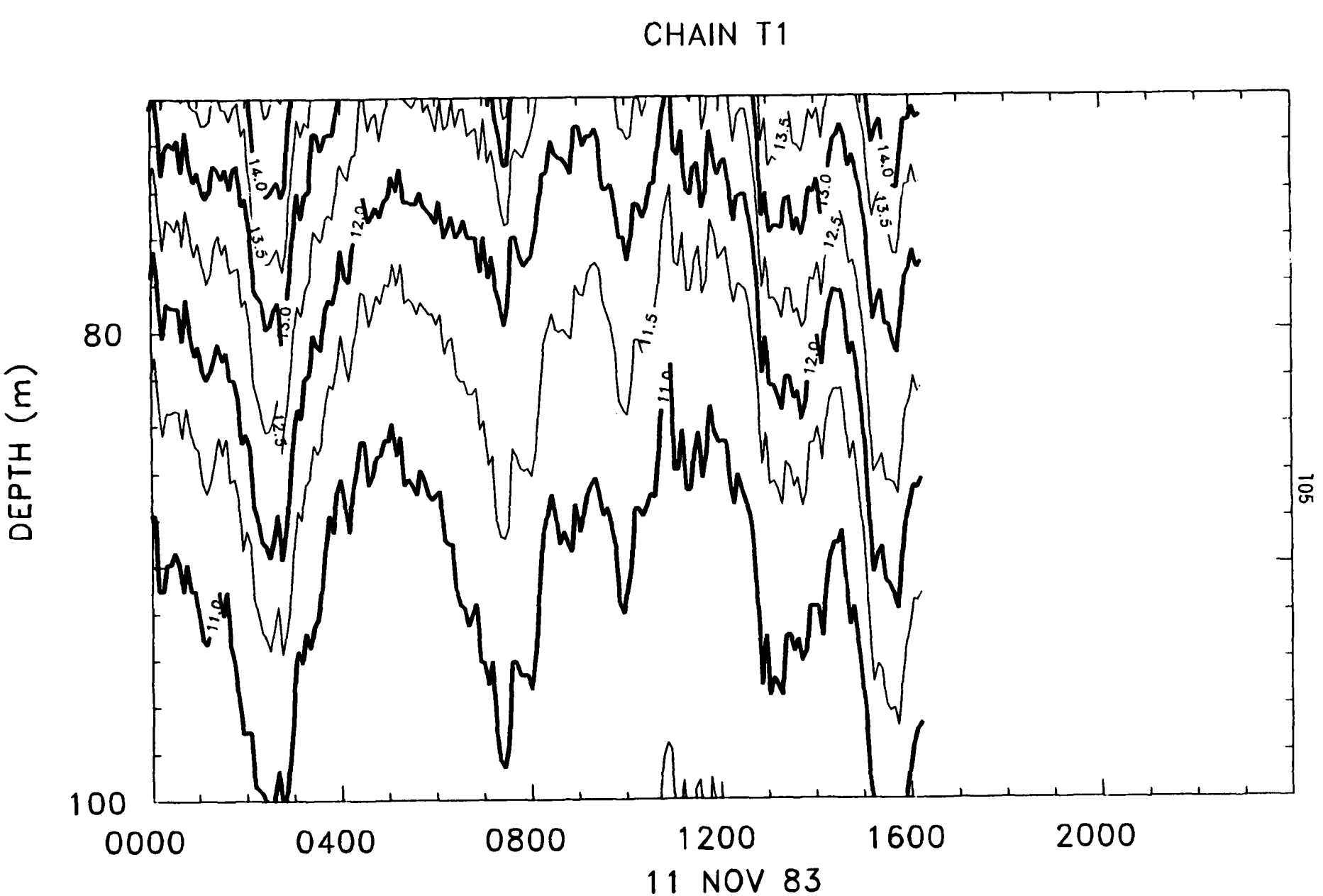
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DEPTH (m)
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105
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11 NOV 83
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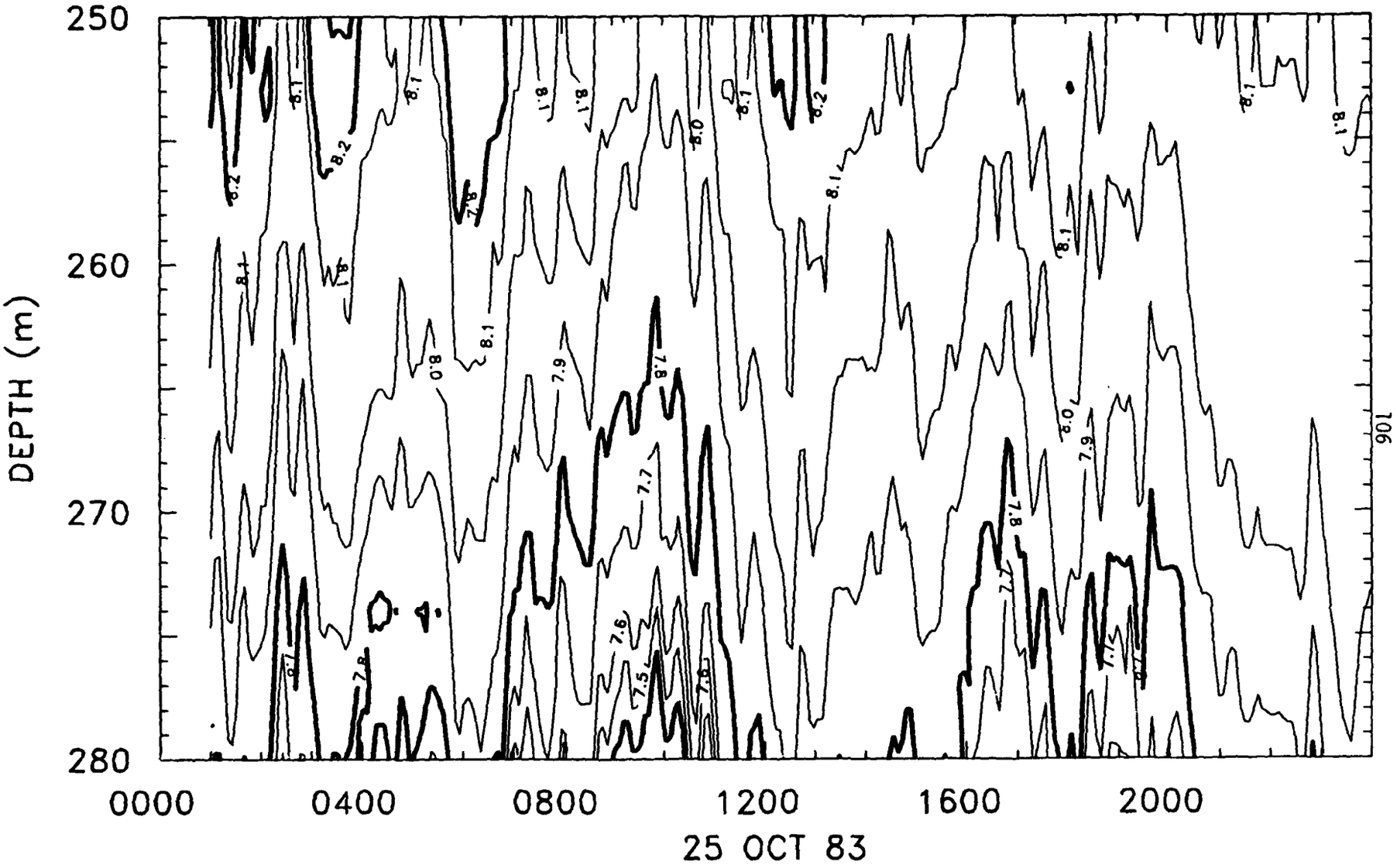
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DEPTH (m)
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260
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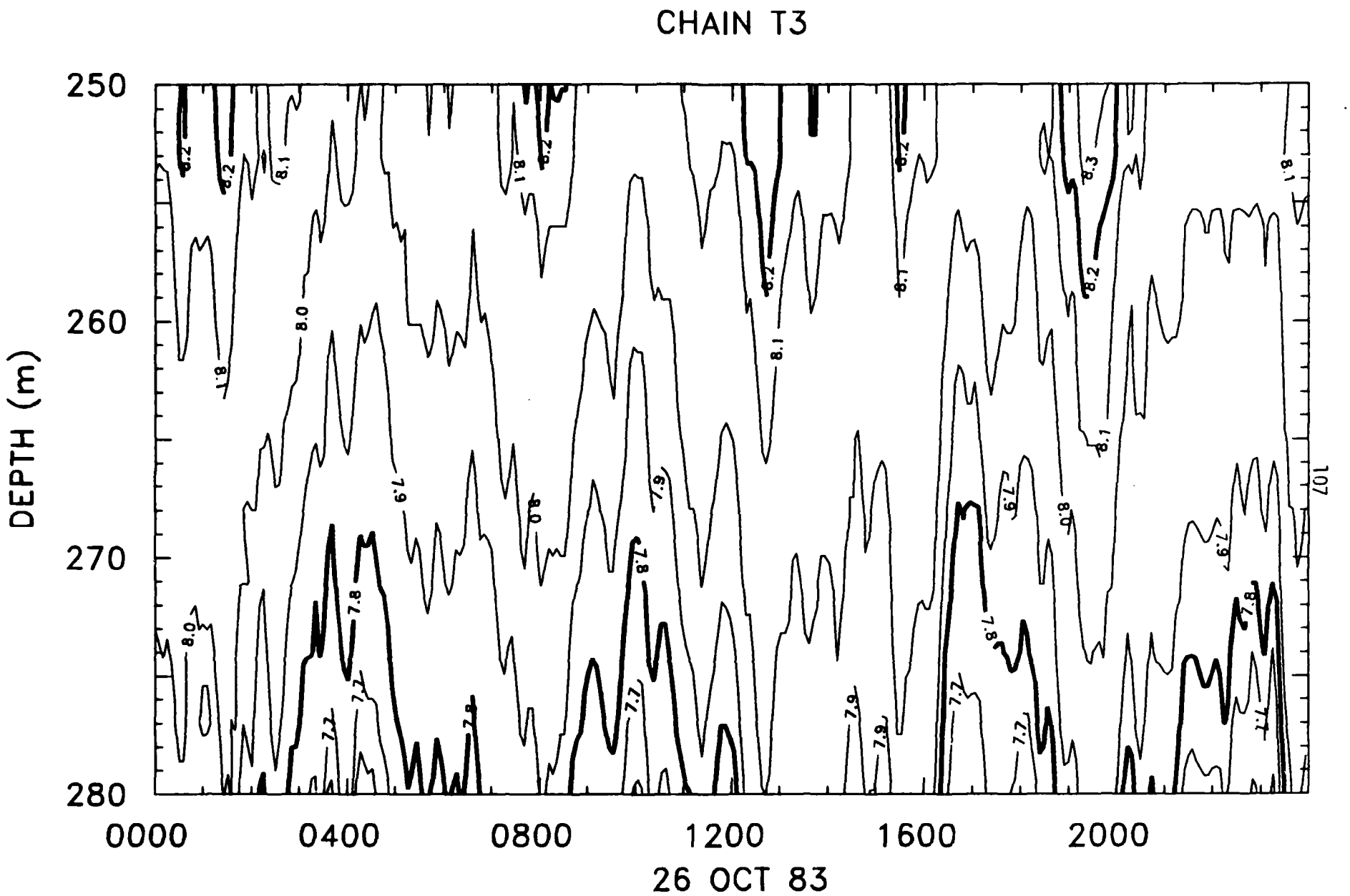
280
0000
0400
0800
1200
1600
2000
25 OCT 83
106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DEPTH (m)
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280
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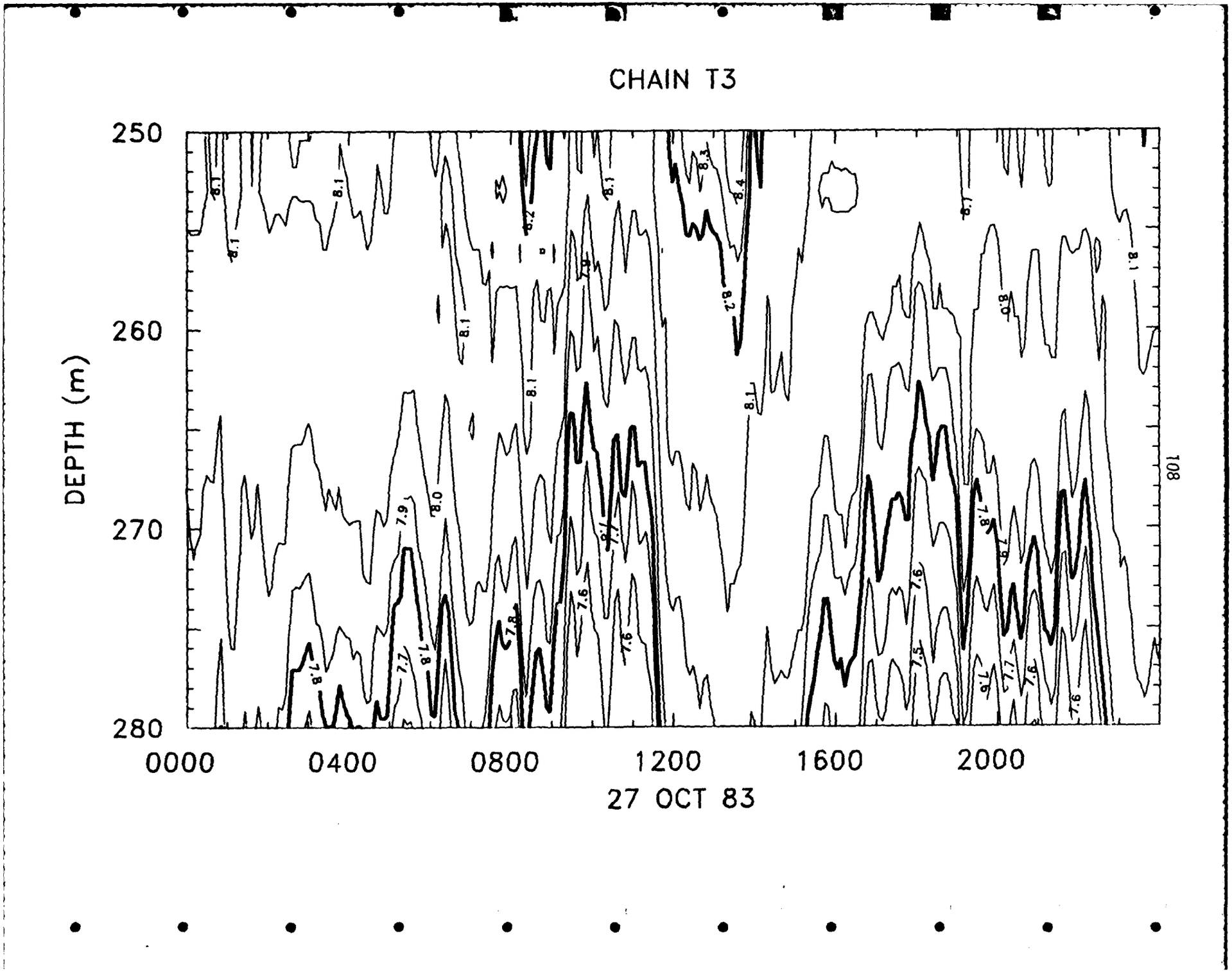
0800
1200
1600
2000
26 OCT 83
107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DEPTH (m)
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260
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27 OCT 83
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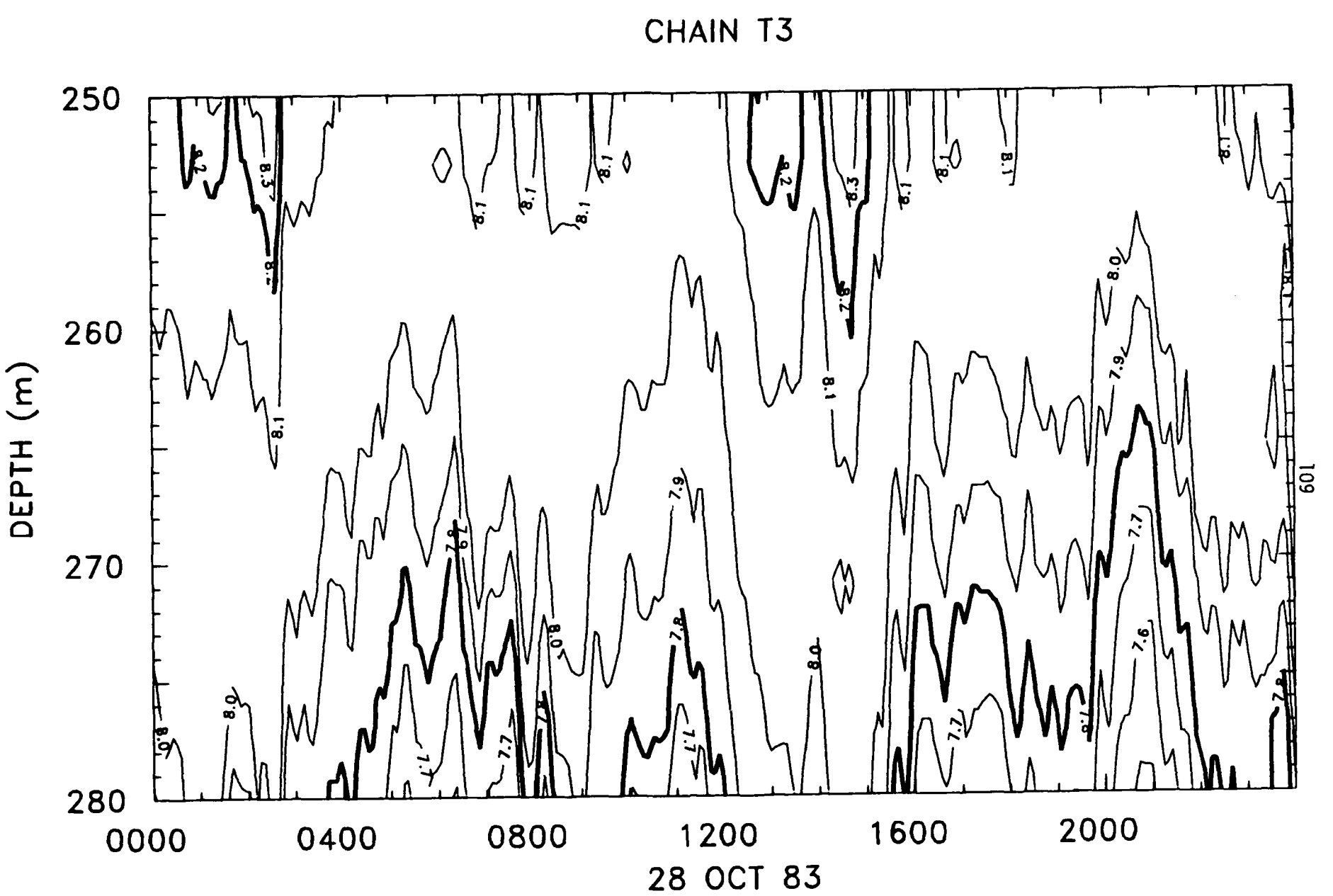
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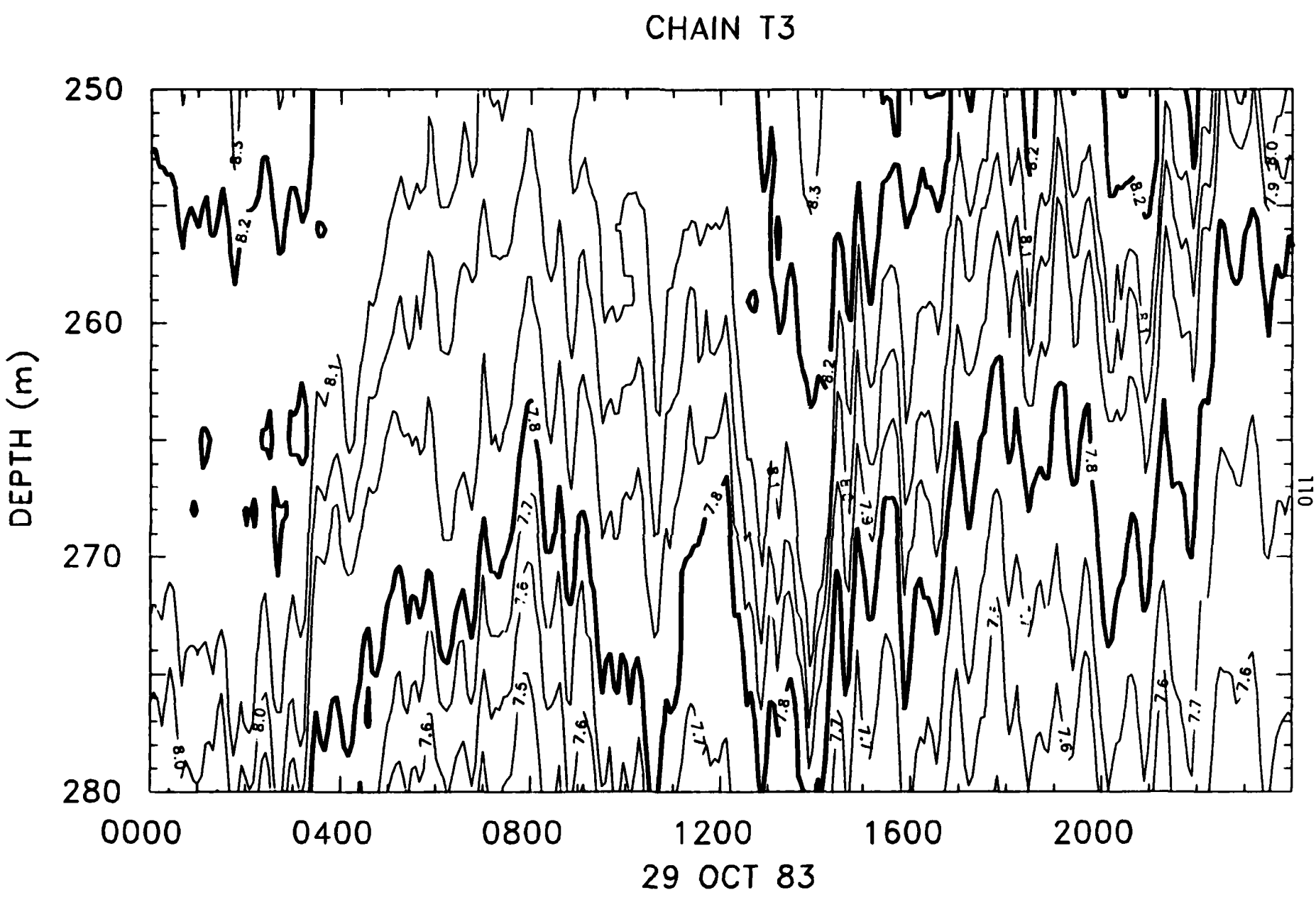
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DEPTH (m)
0000
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29 OCT 83
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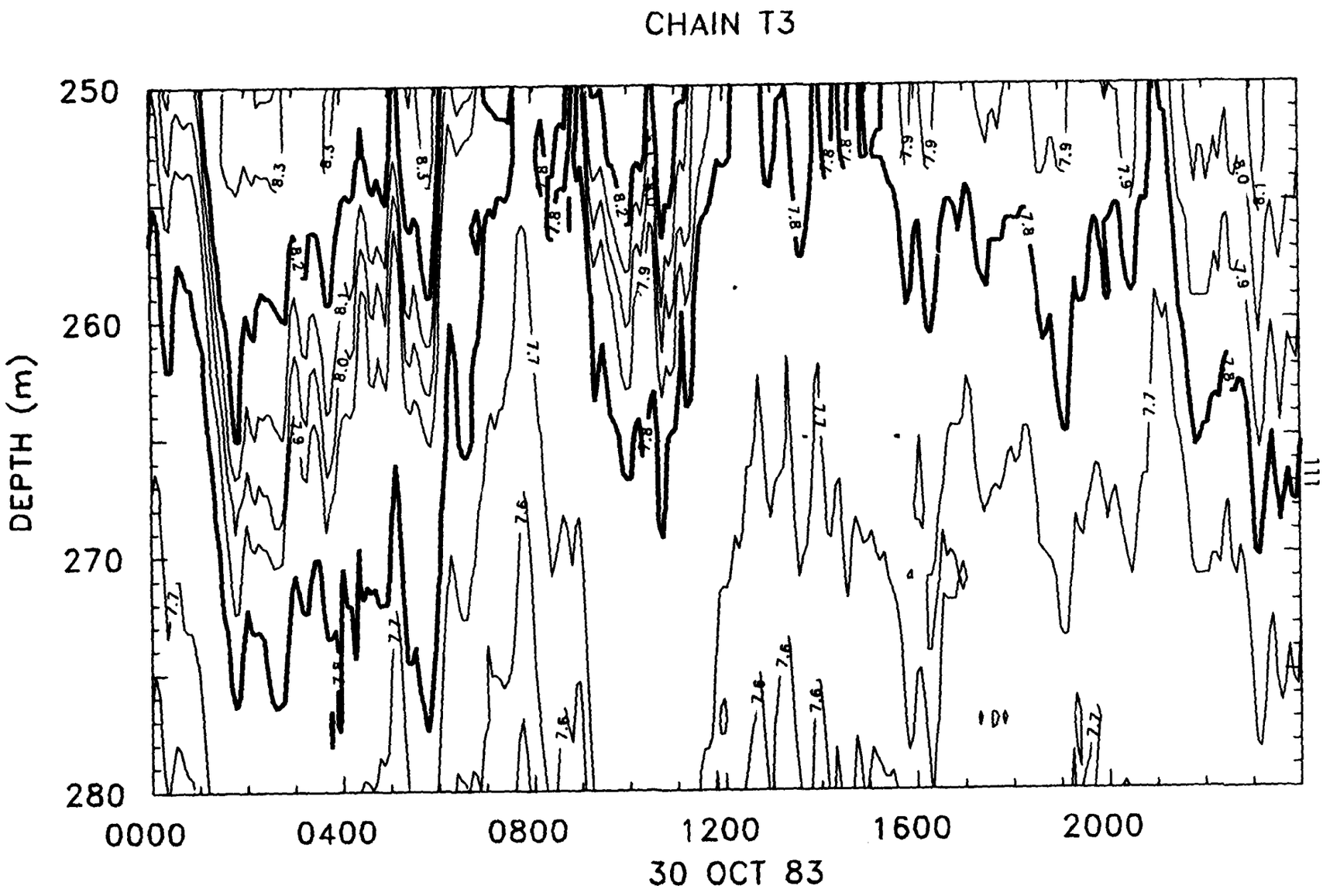
CHAIN T3
250
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270
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DEPTH (m)
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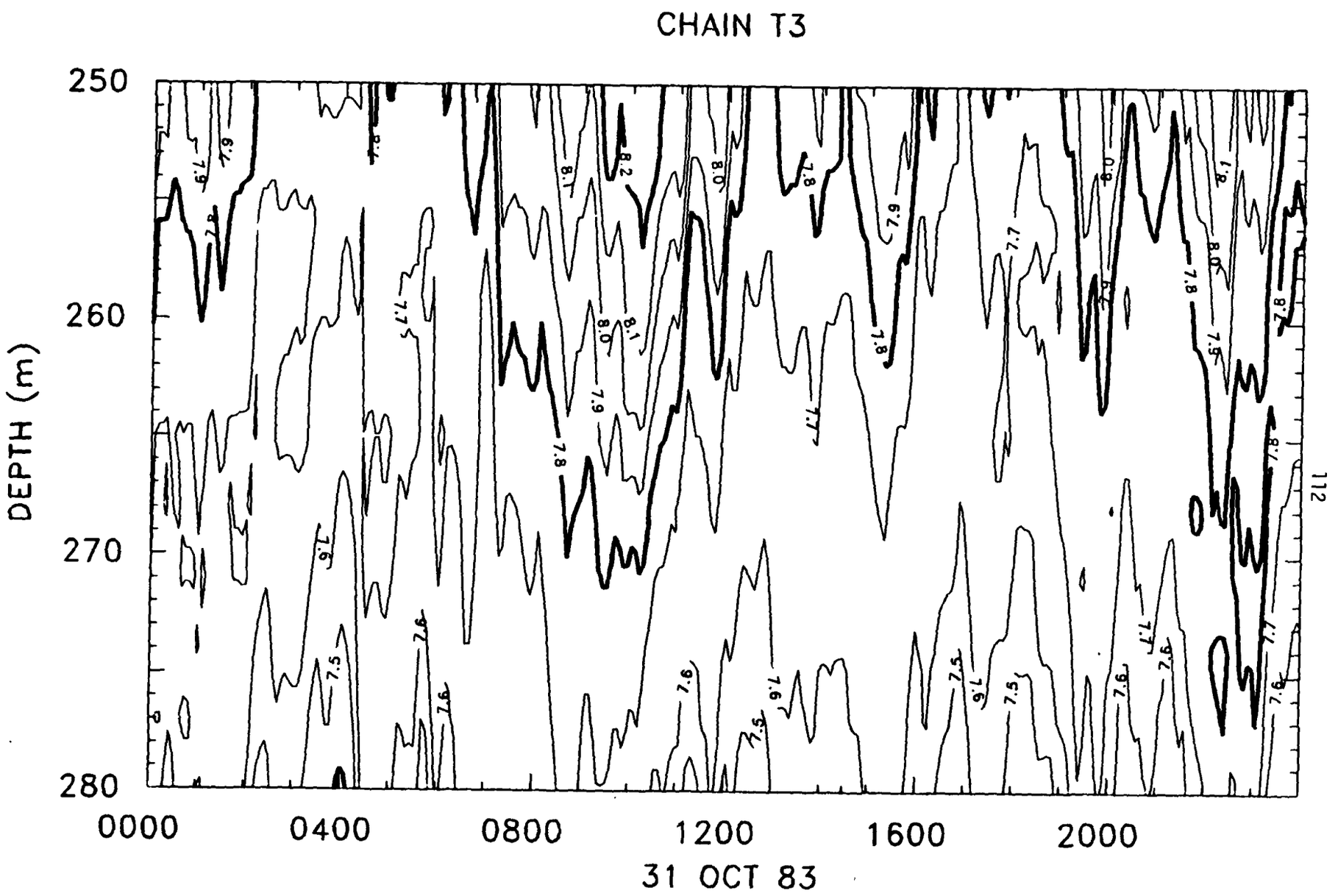
1200
1600
2000
30 OCT 83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DEPTH (m)
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260
270
280
0000
0400
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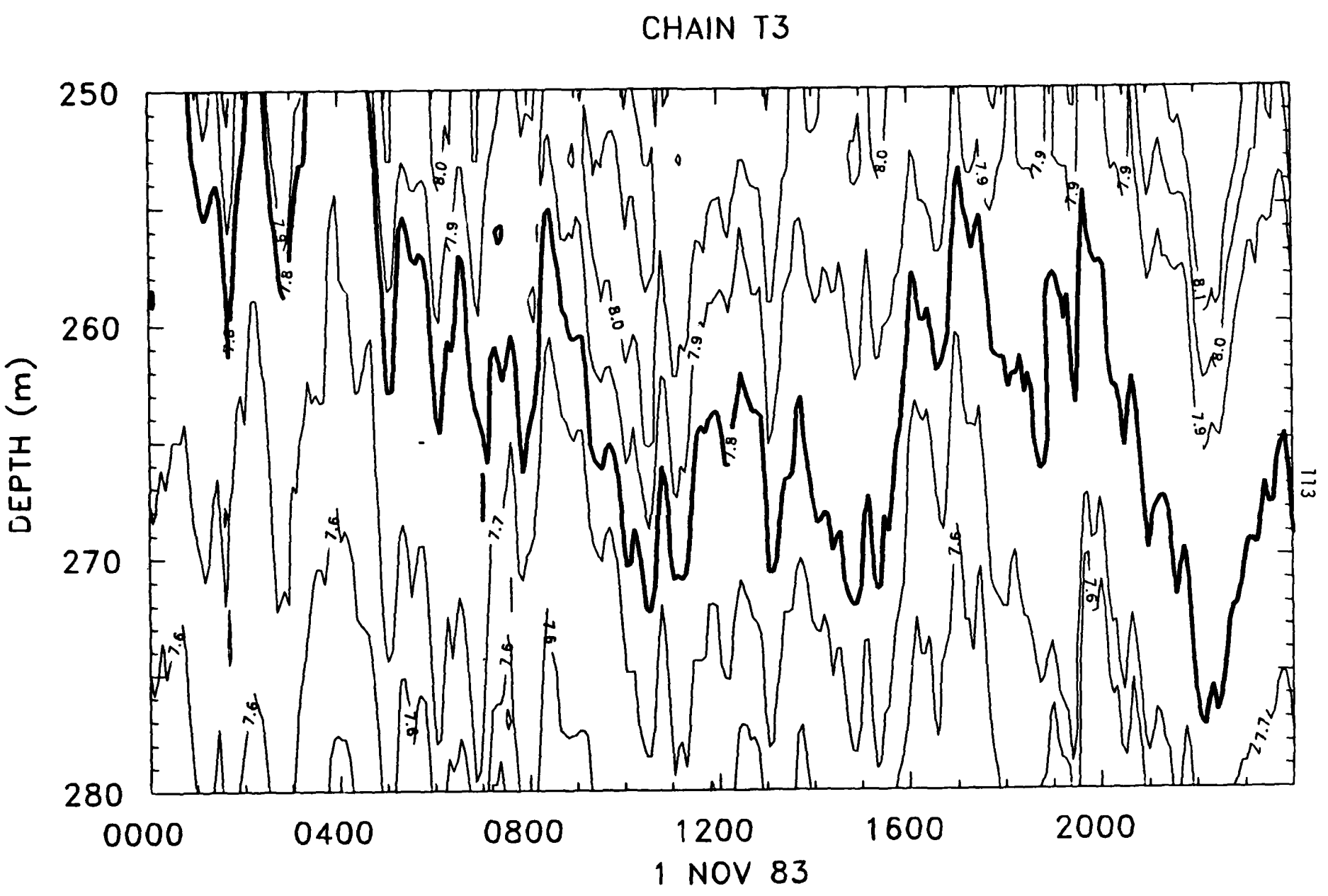
31 OCT 83
112


CHAIN T3
250
260
270
280
DEPTH (m)
0000
0400
0800
1200
1600
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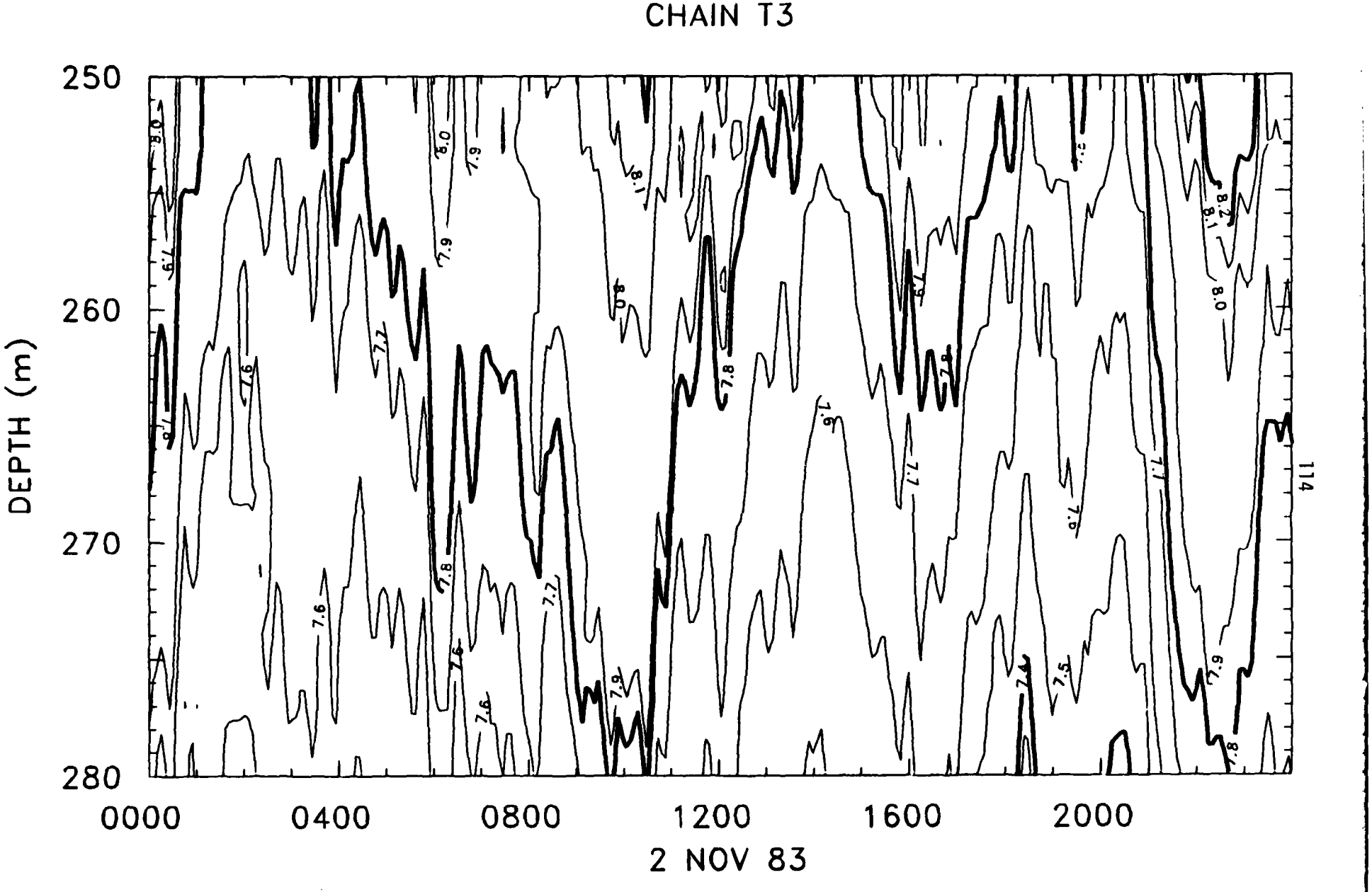
1 NOV 83
113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DEPTH (m)
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2000
2 NOV 83
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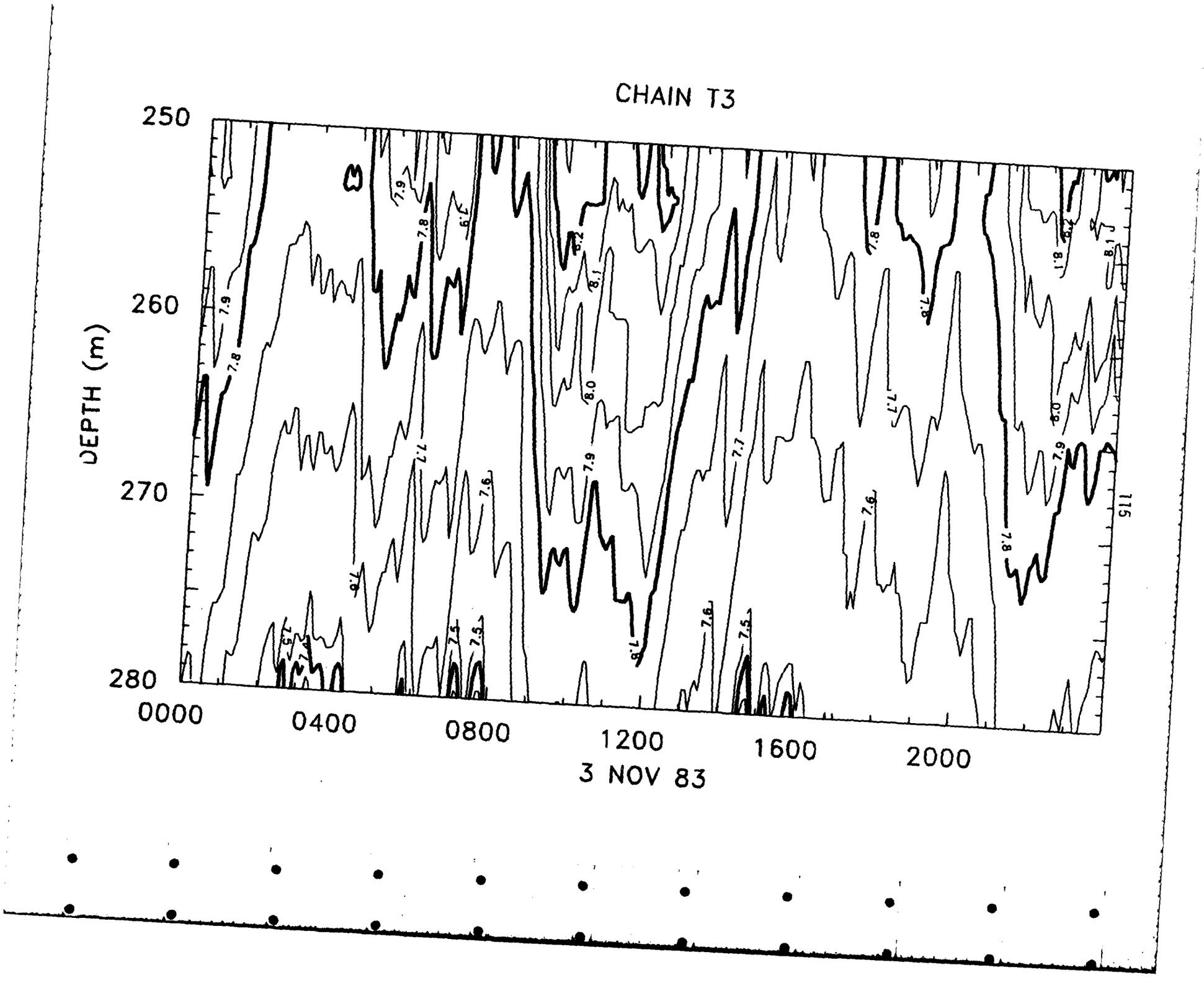
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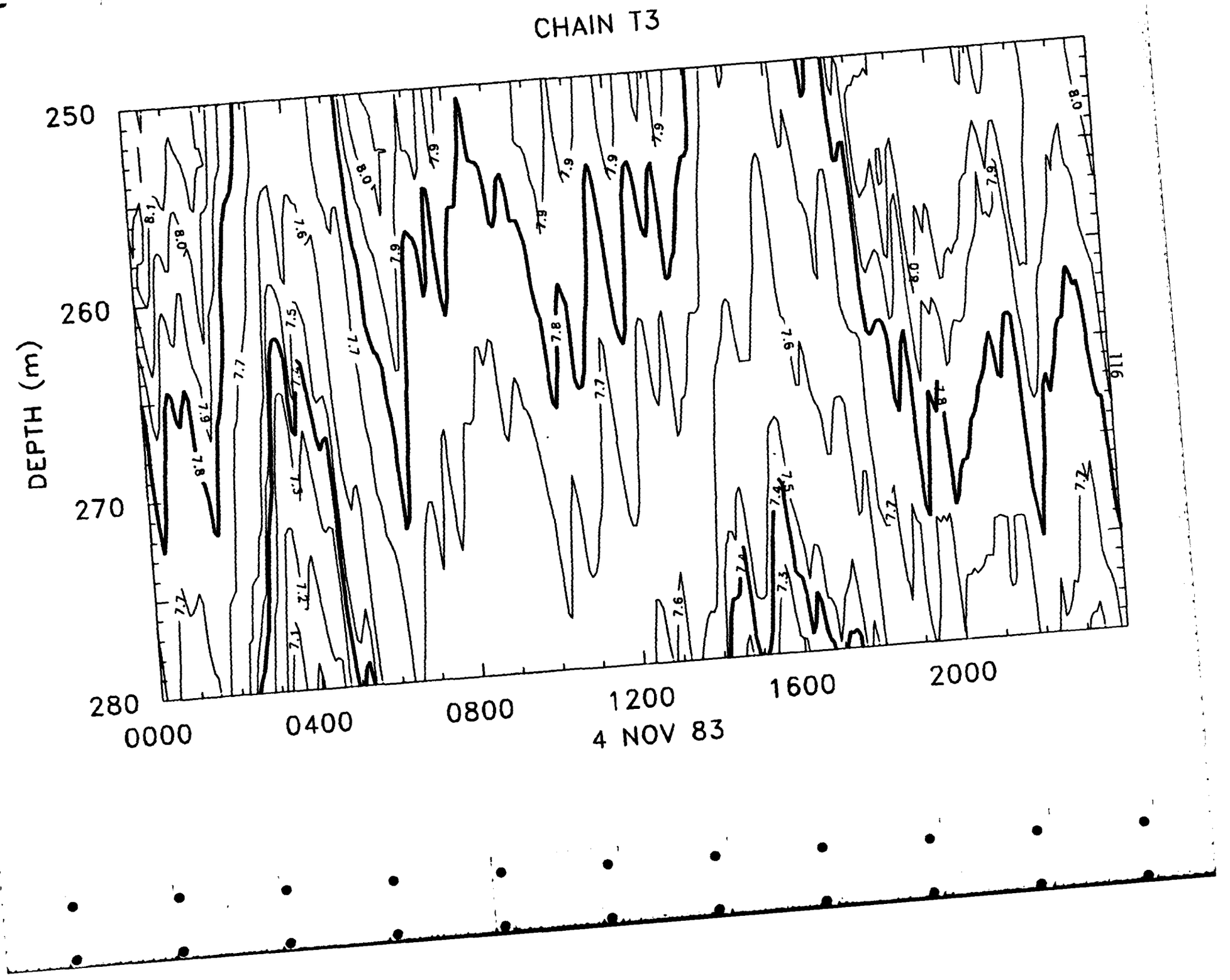
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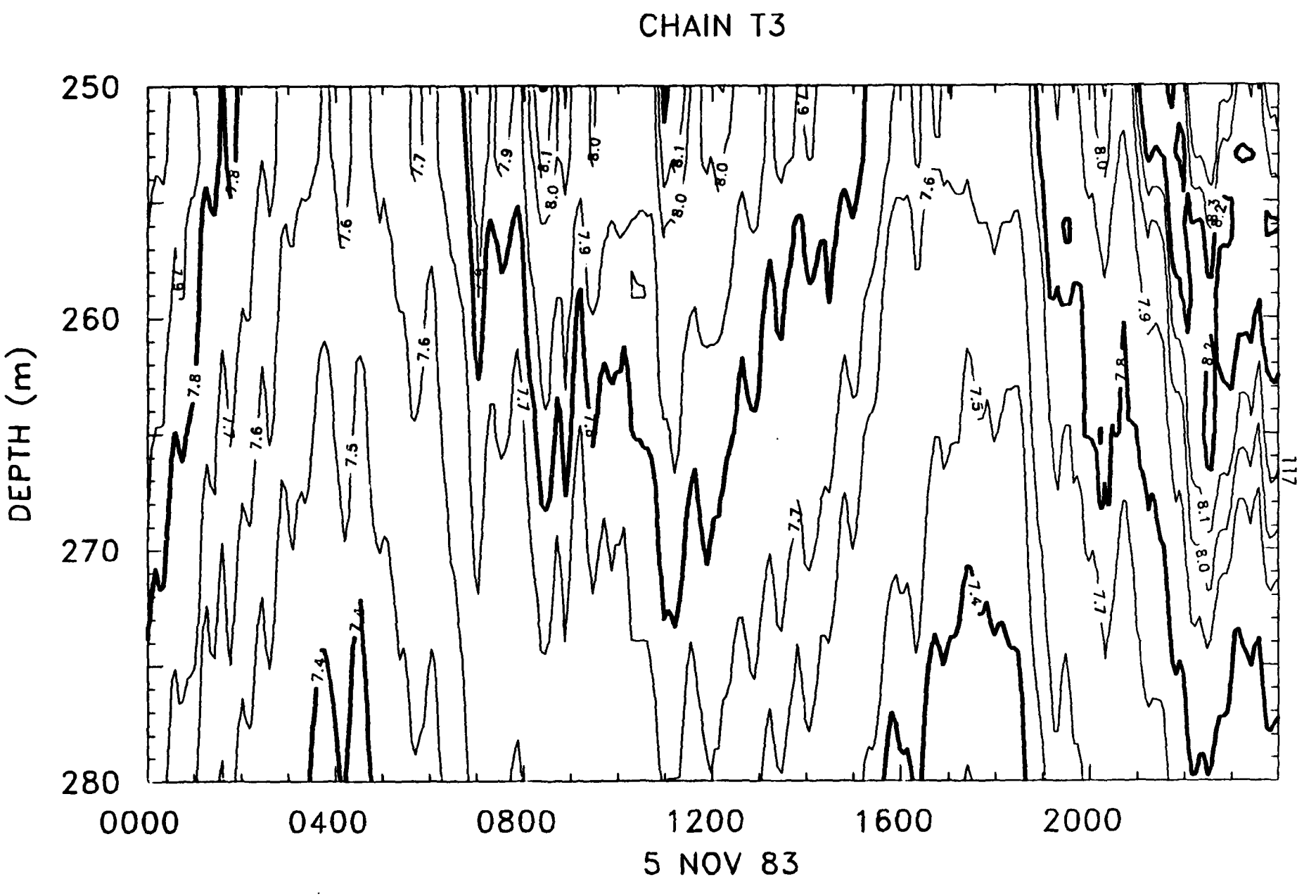
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DEPTH (m)
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5 NOV 83
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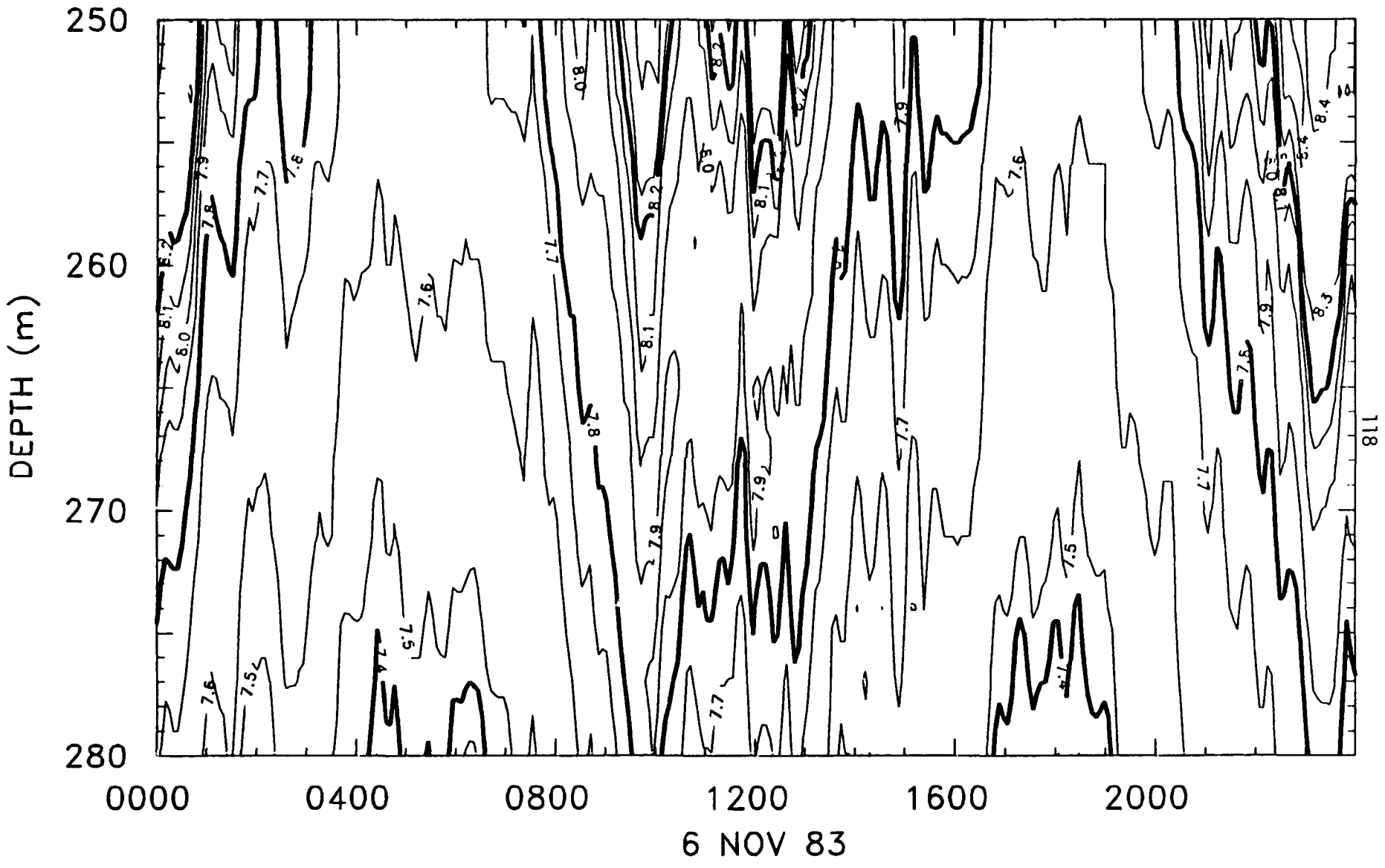
CHAIN T3
DEPTH (m)
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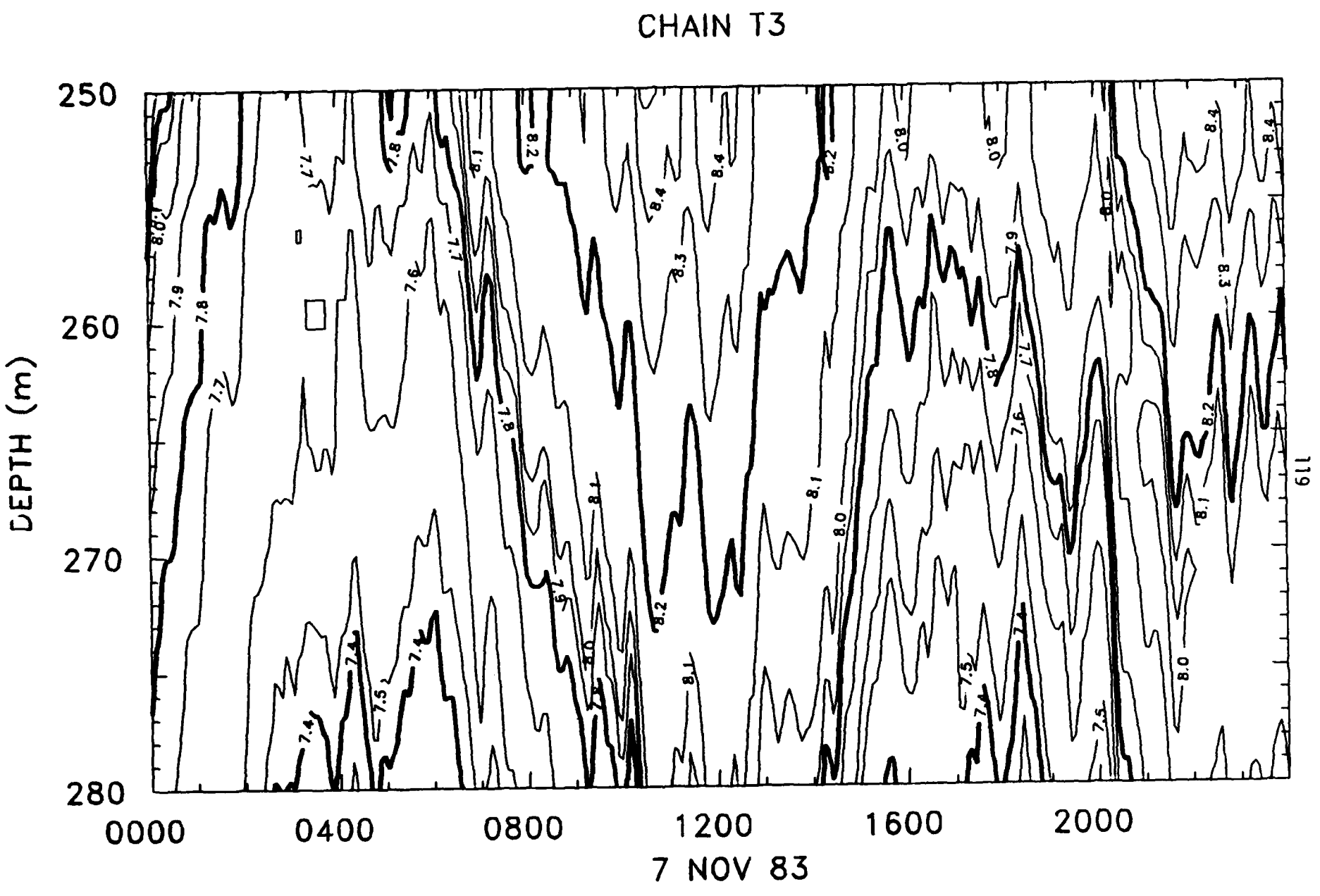
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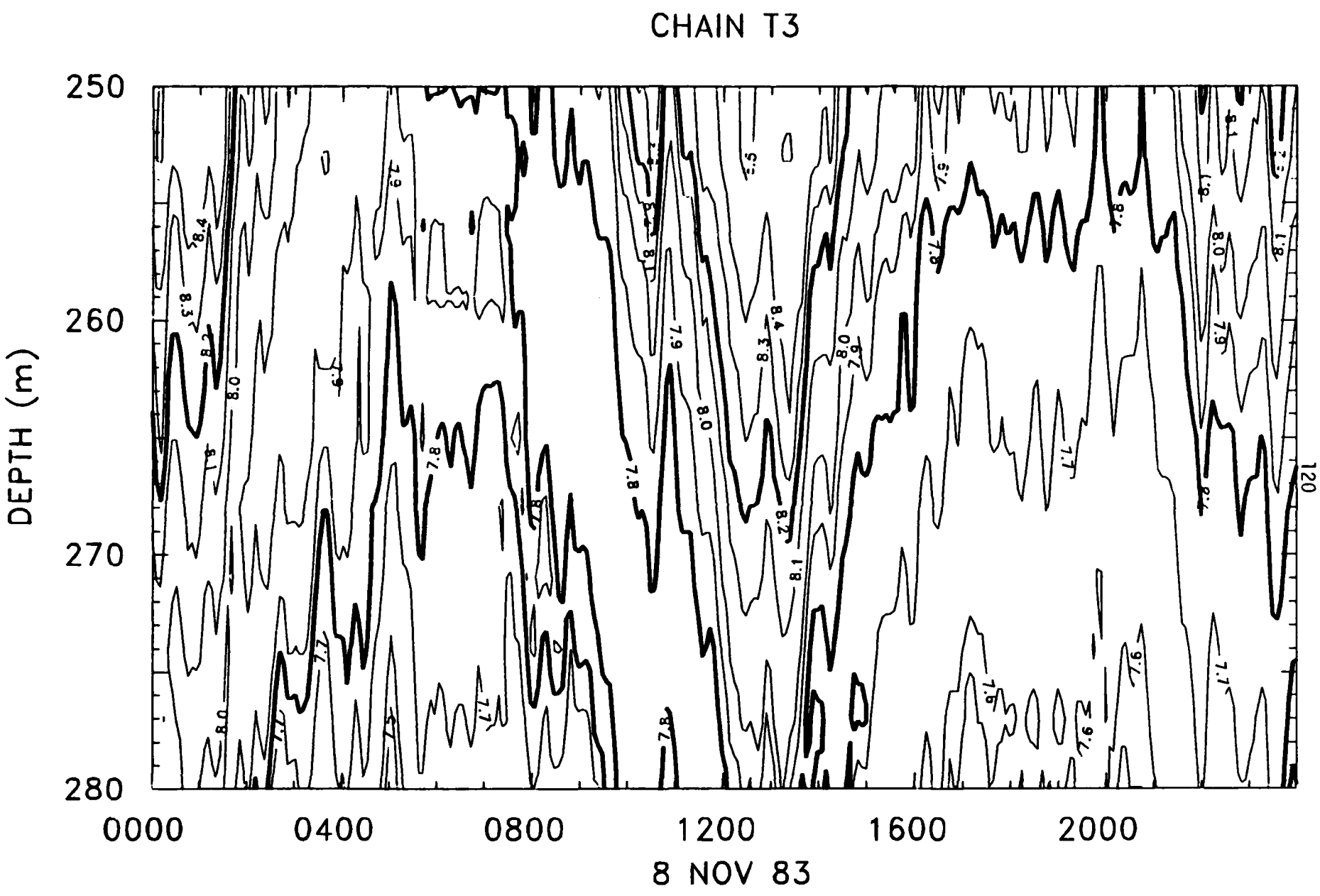
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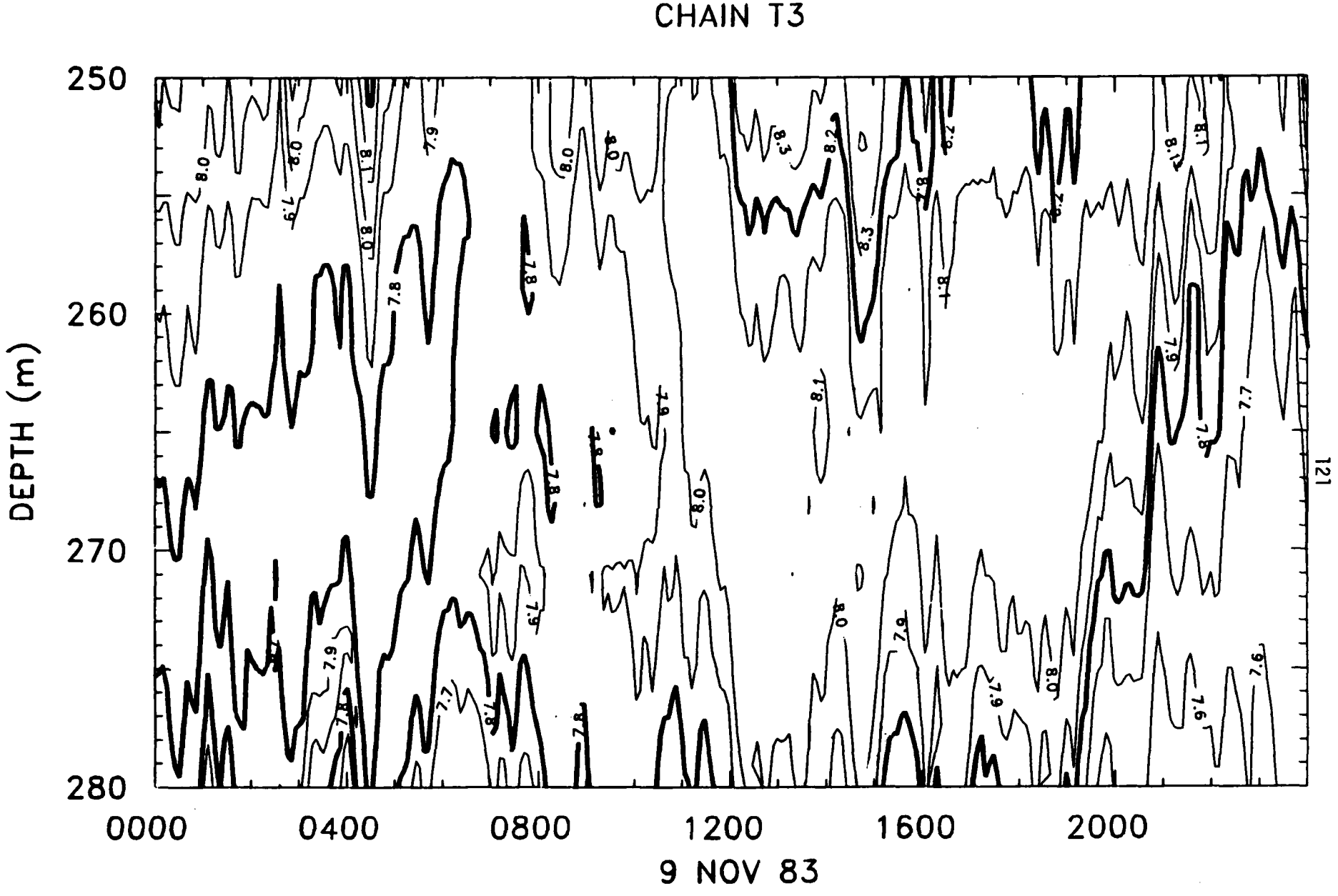
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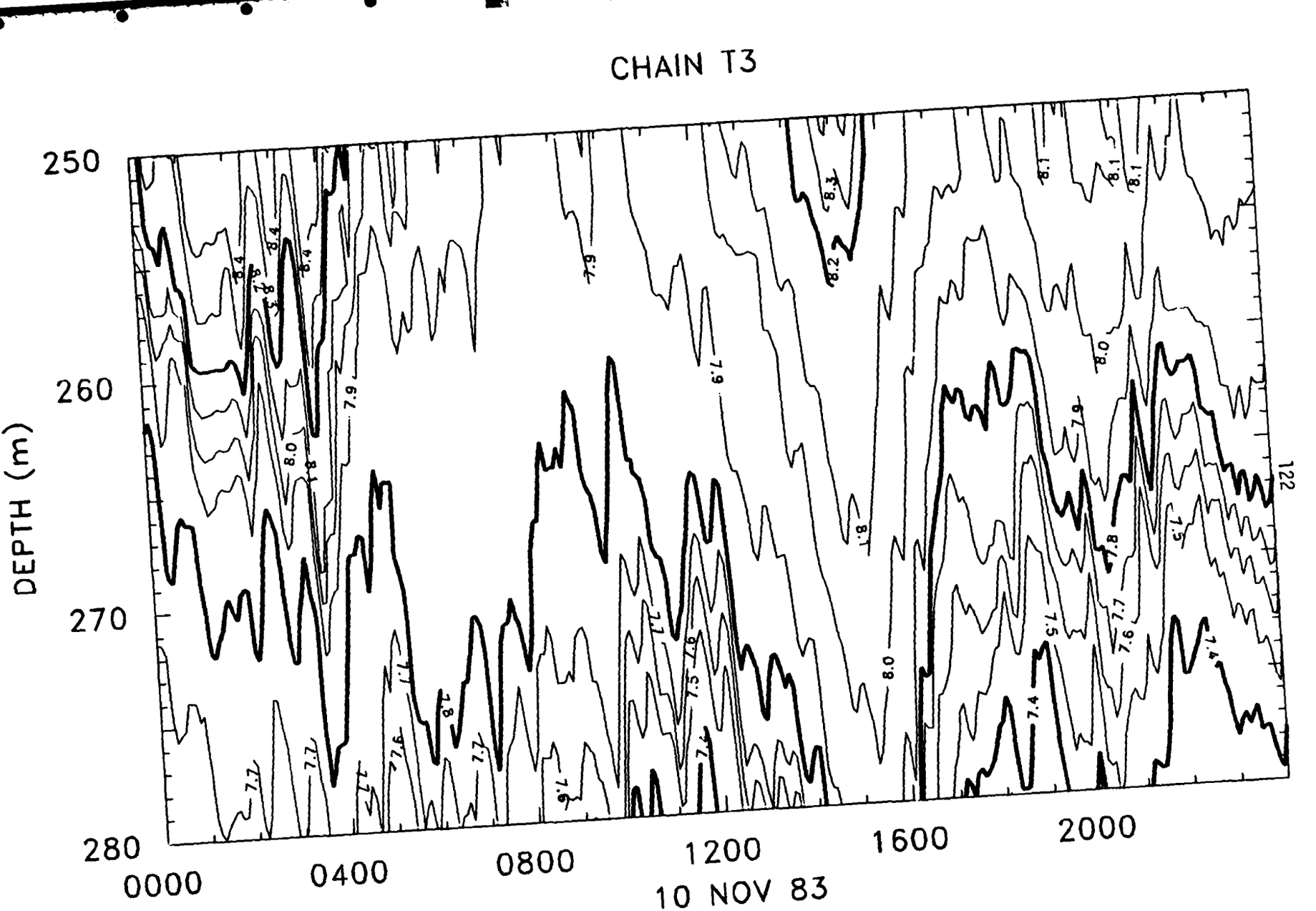
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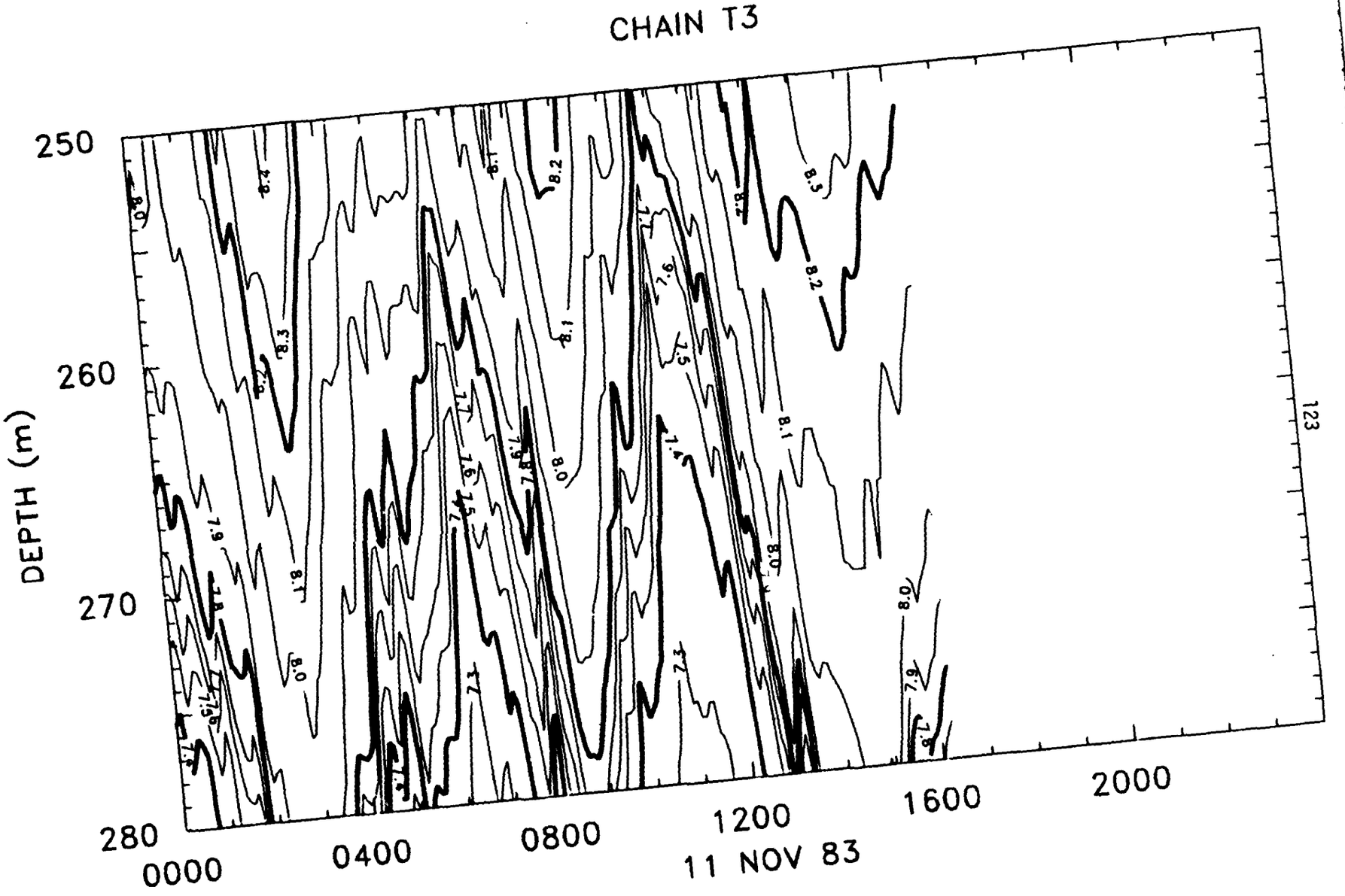
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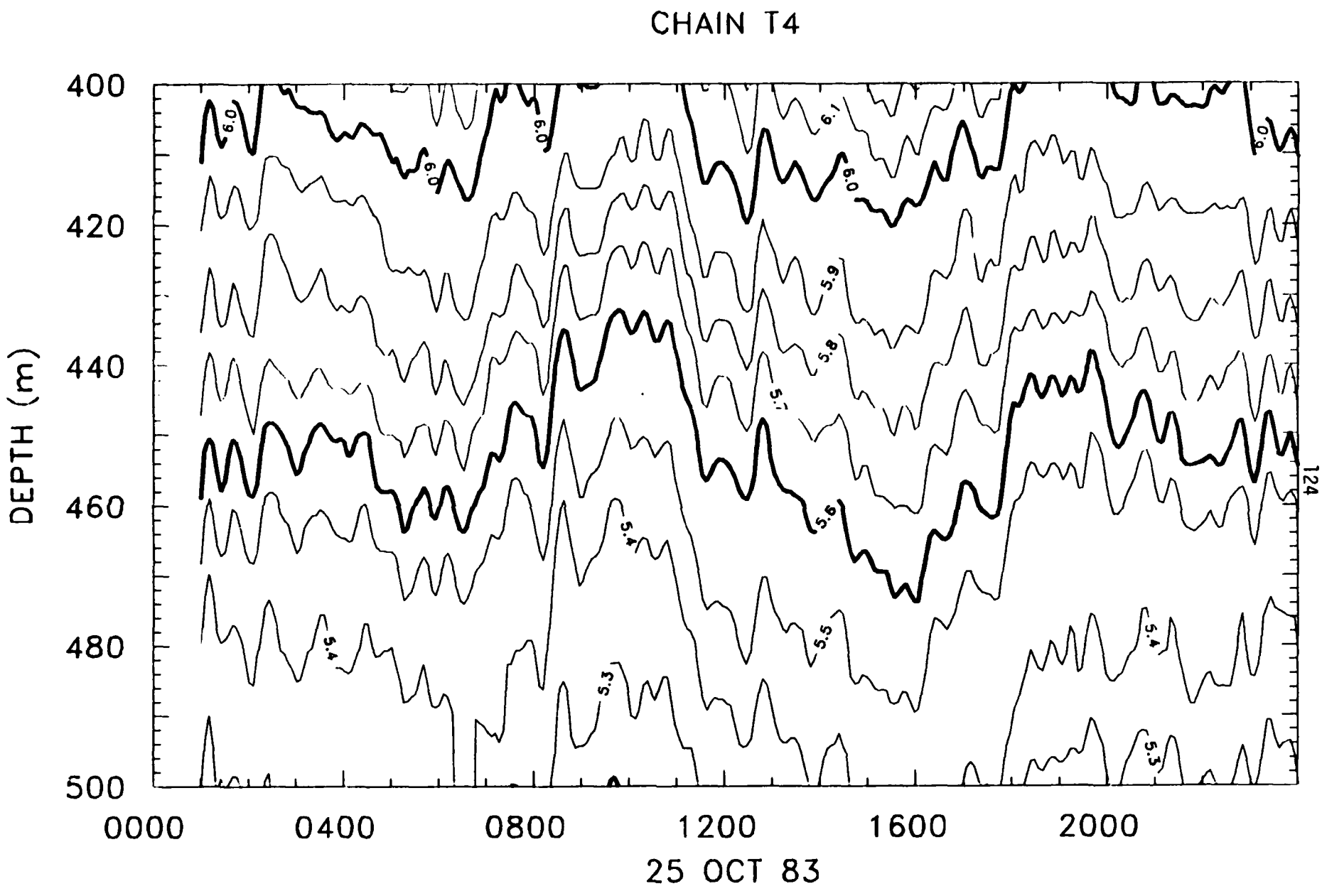
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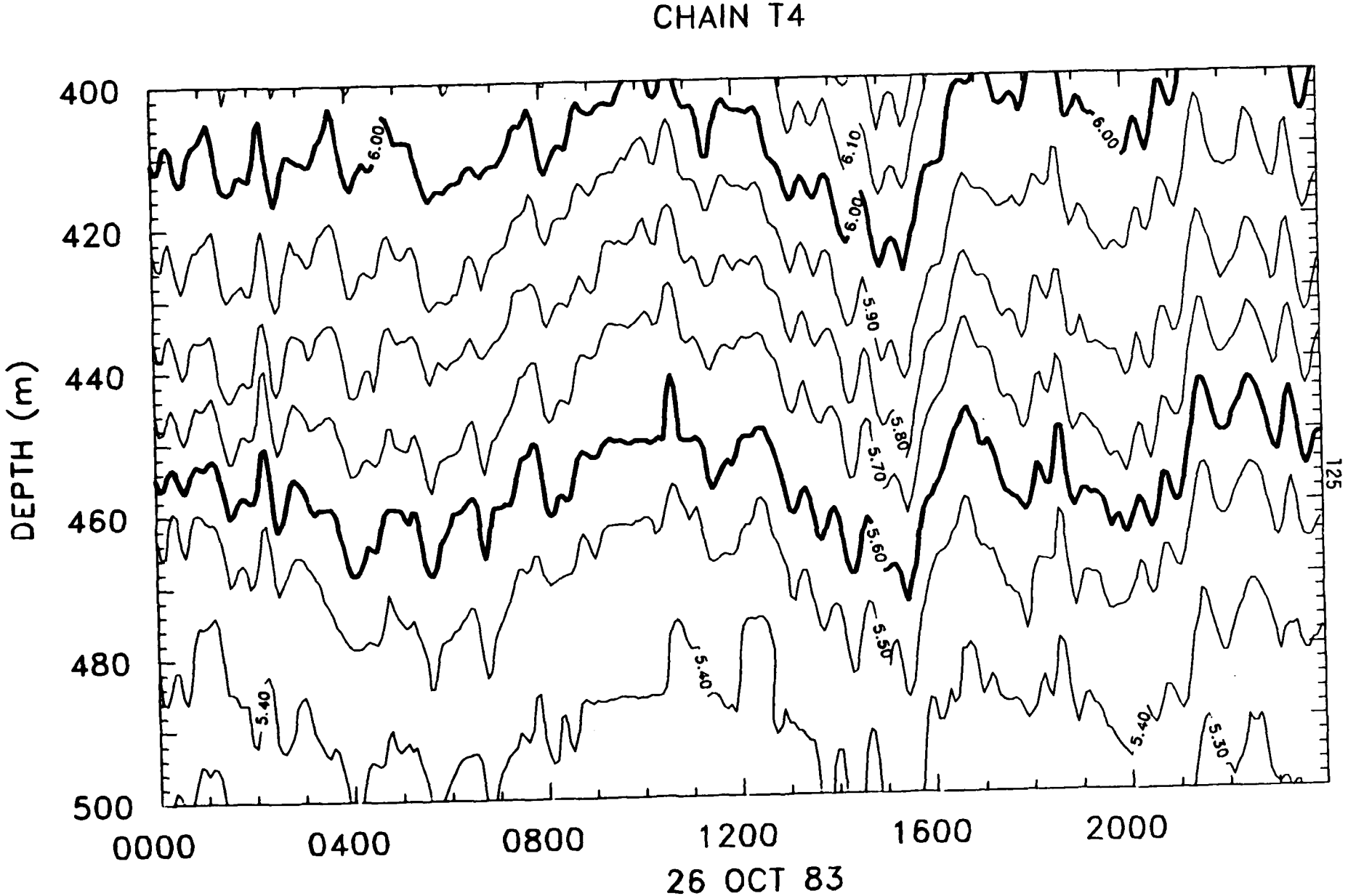
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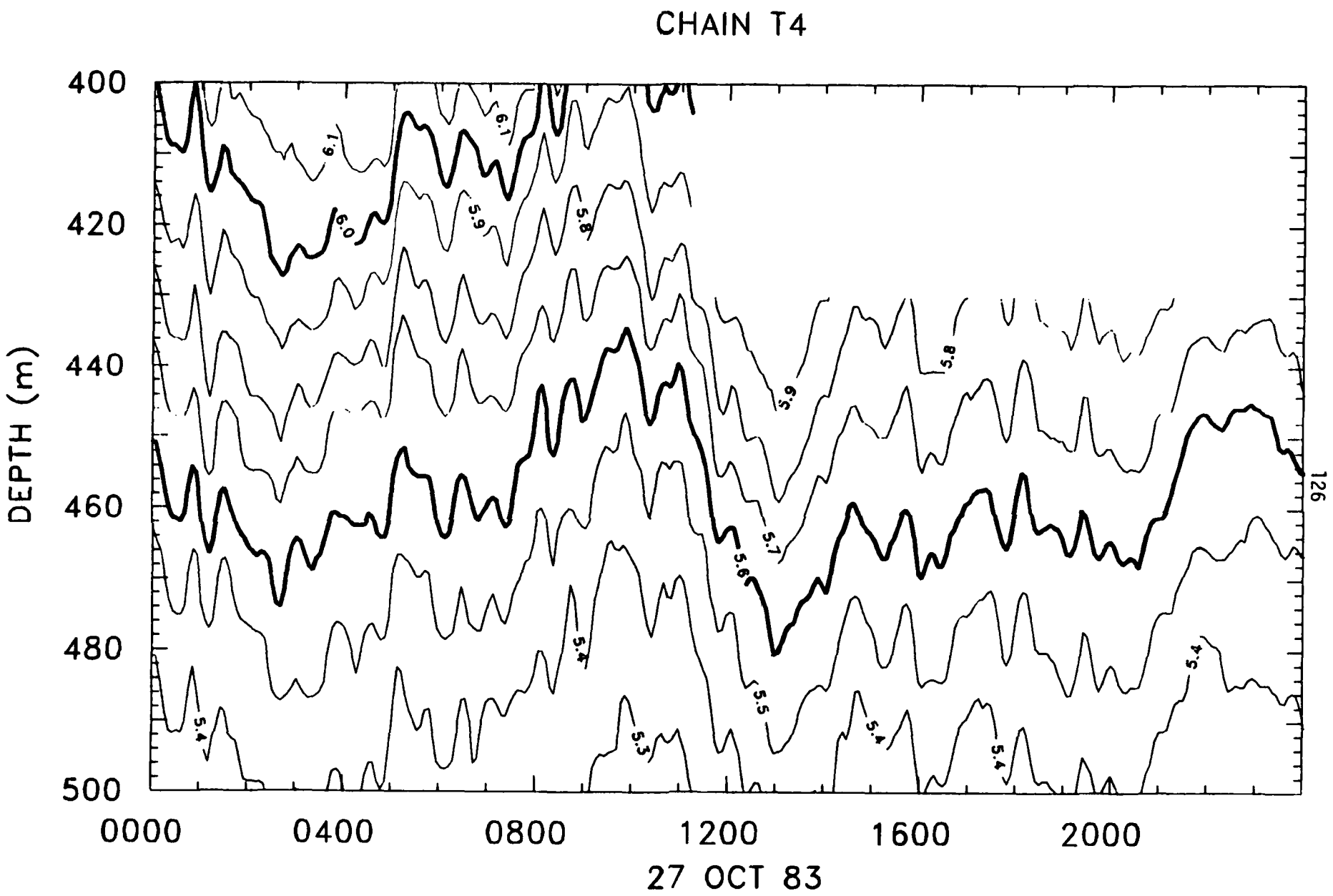
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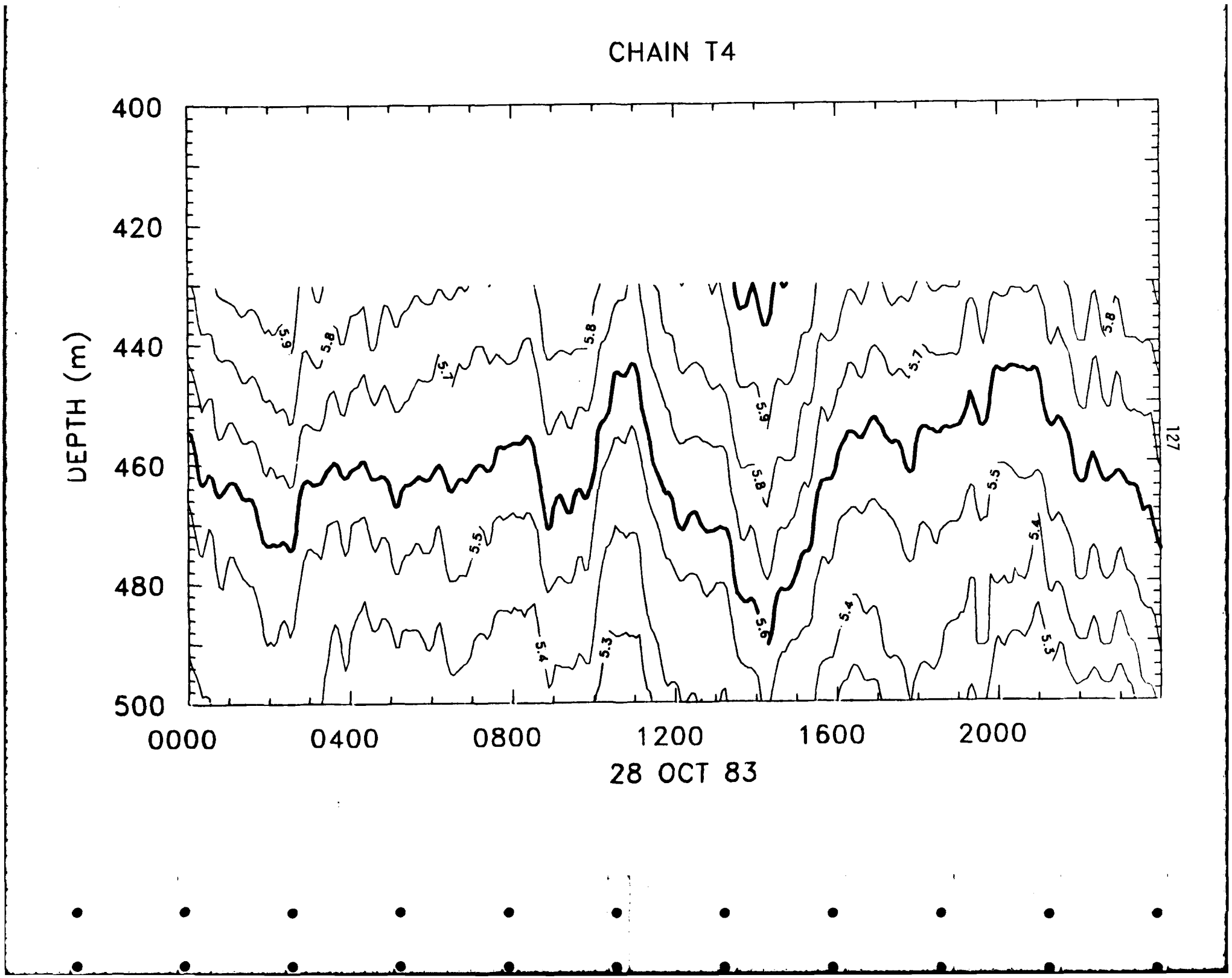
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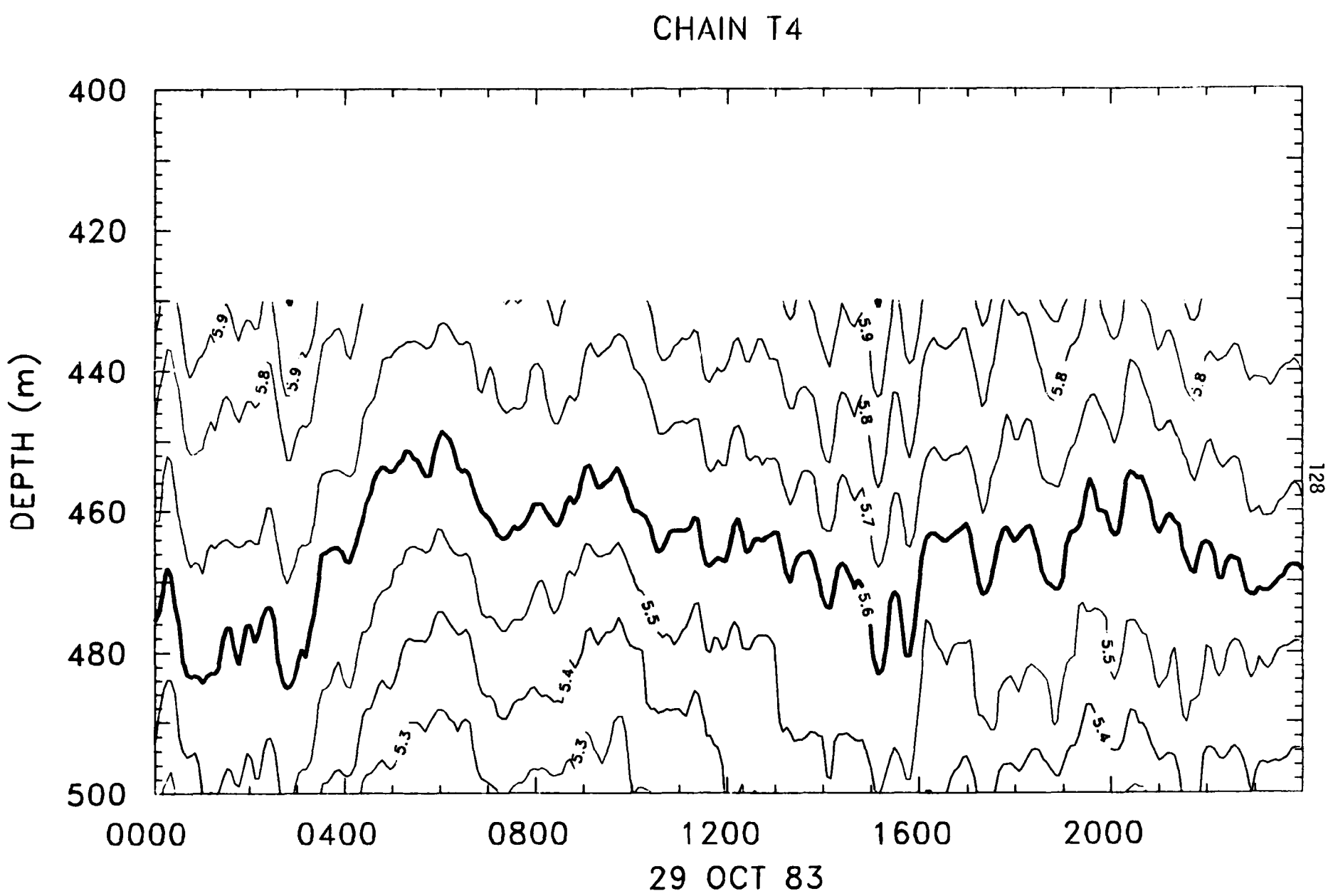
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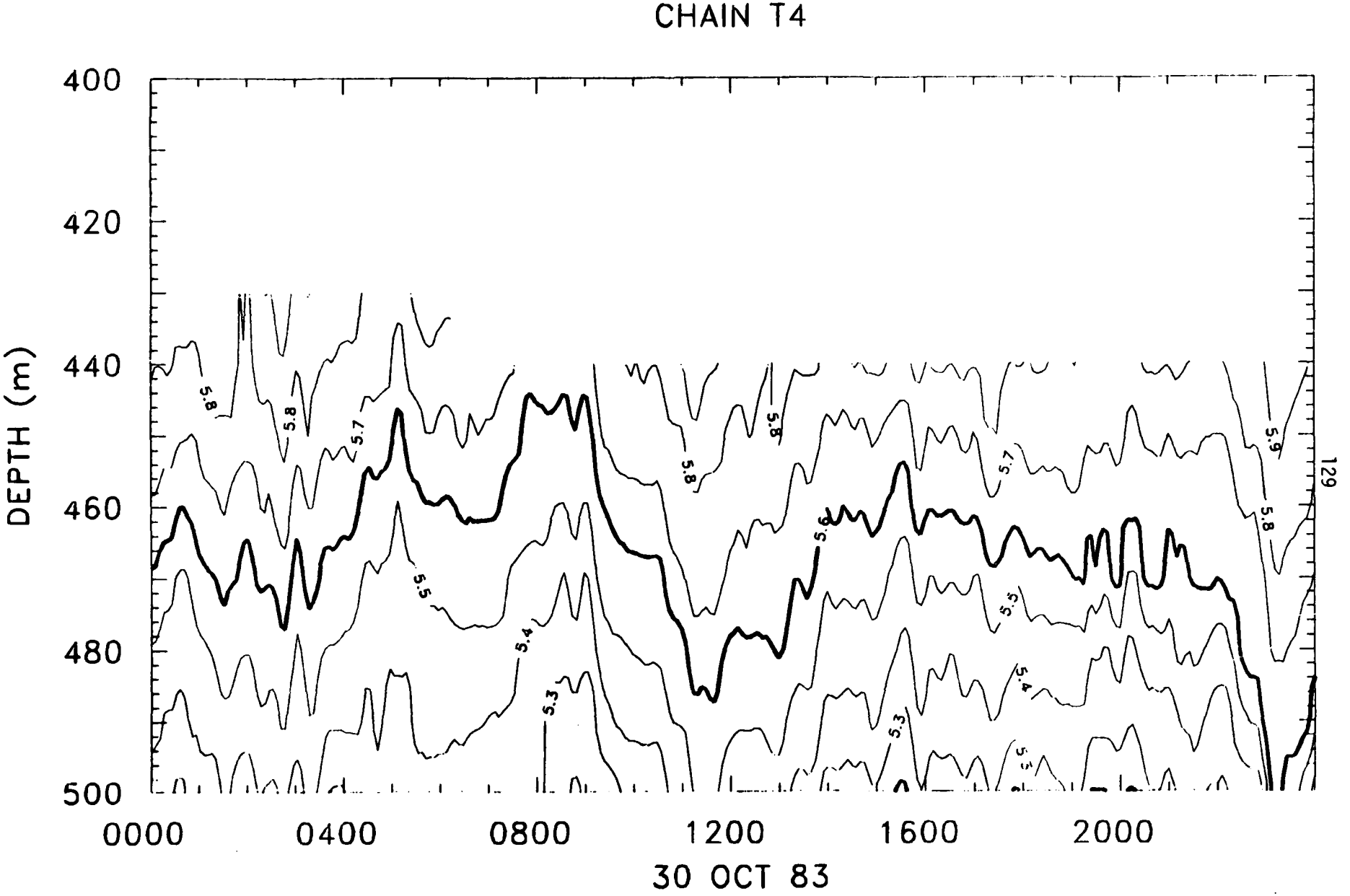
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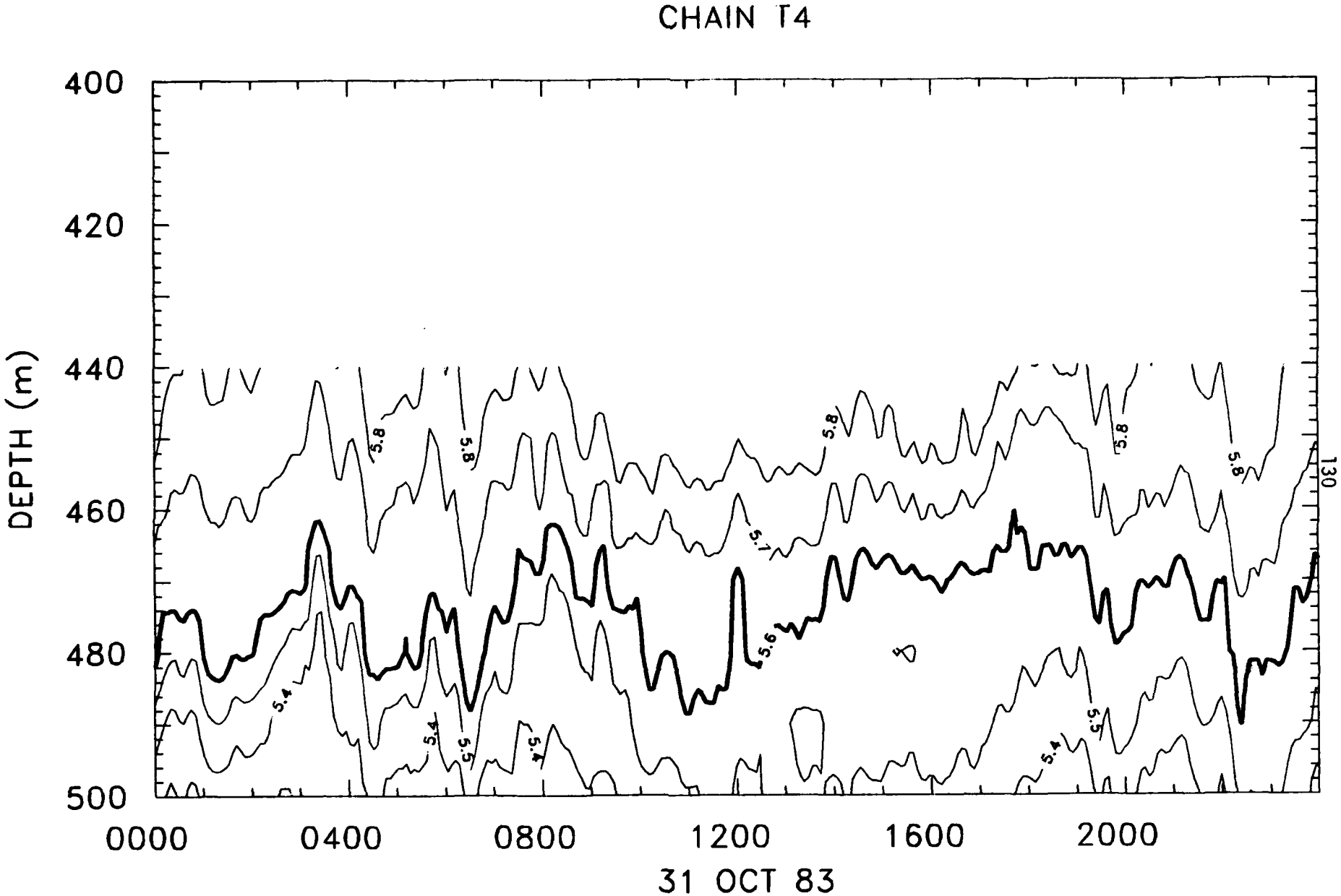
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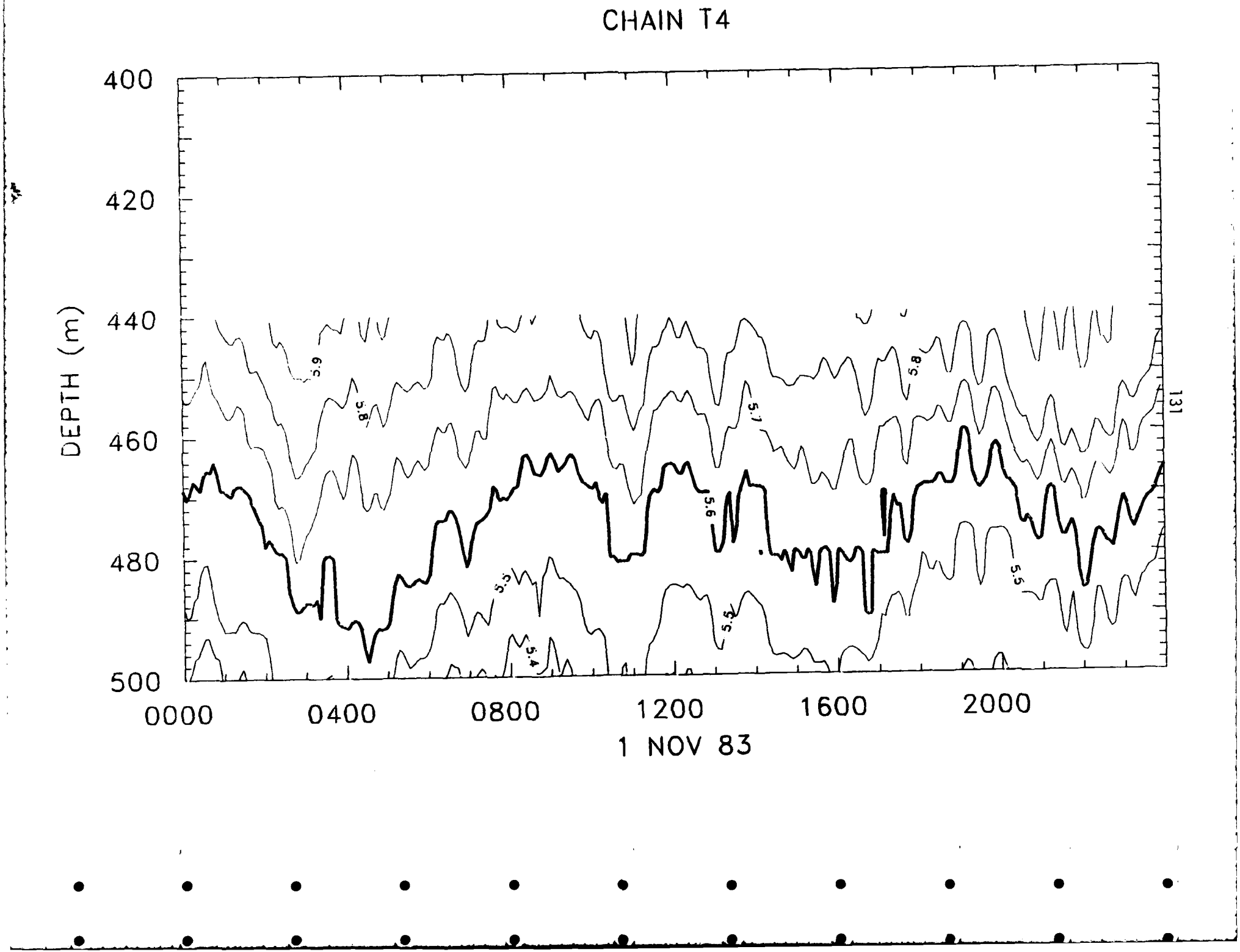
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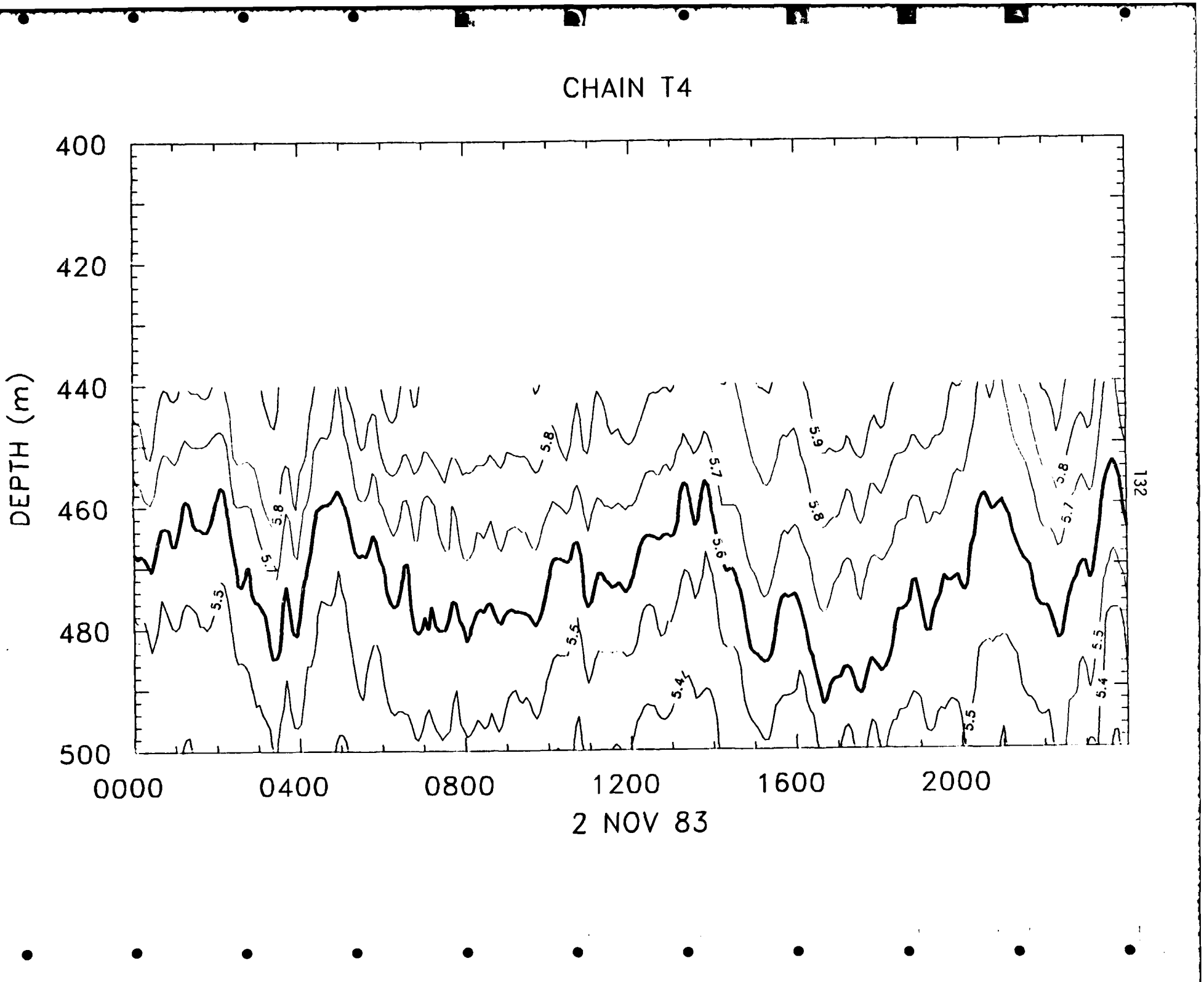
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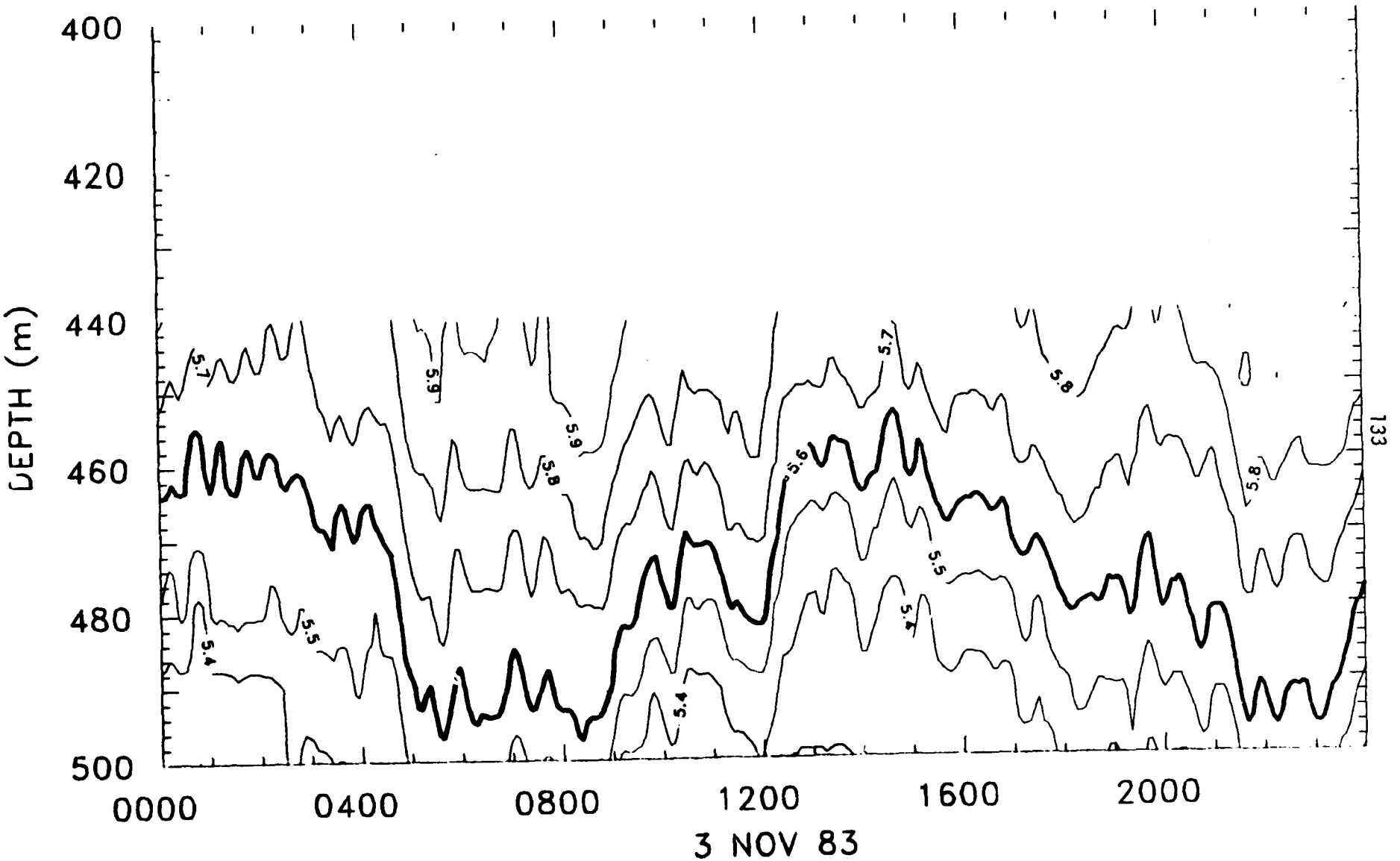
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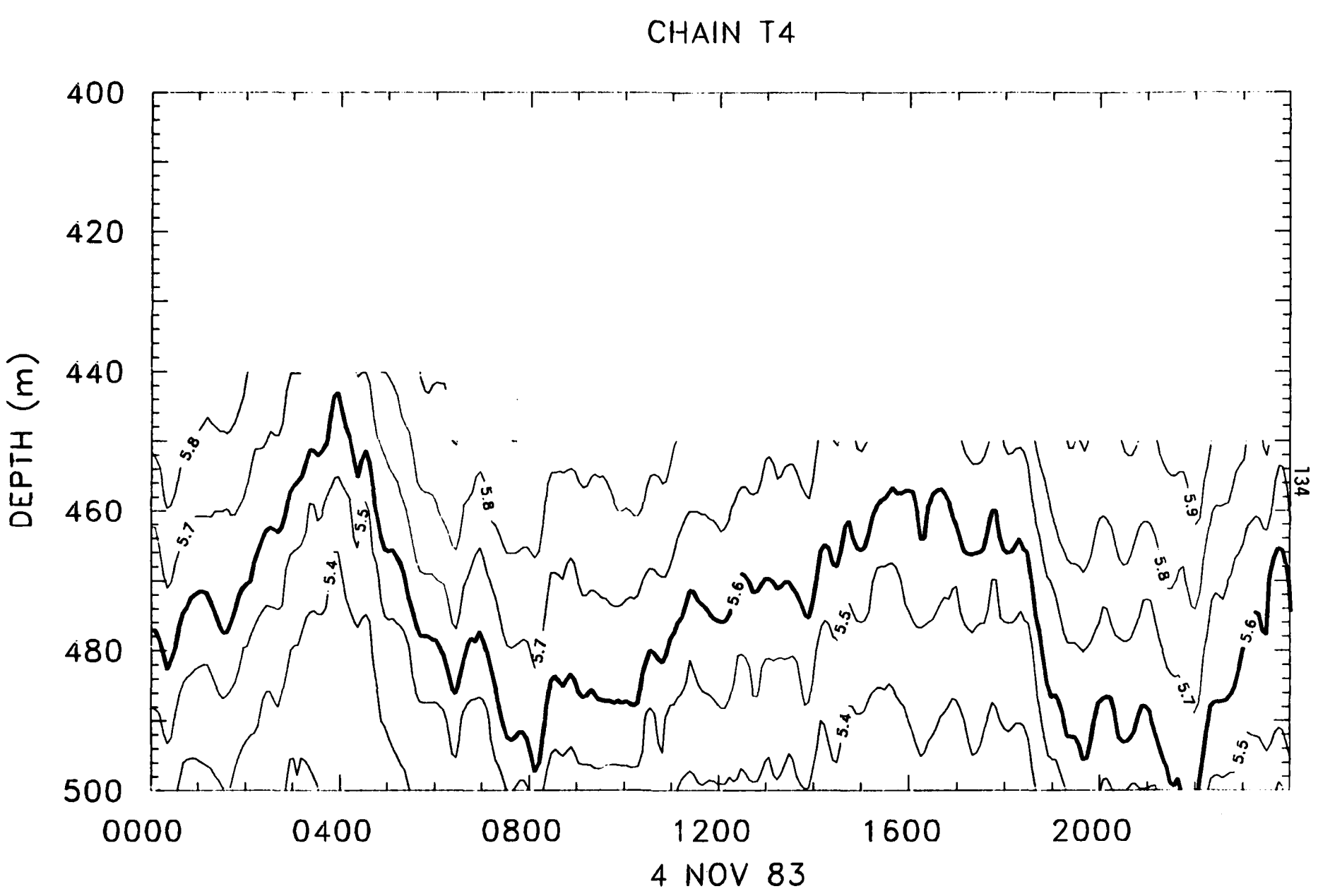
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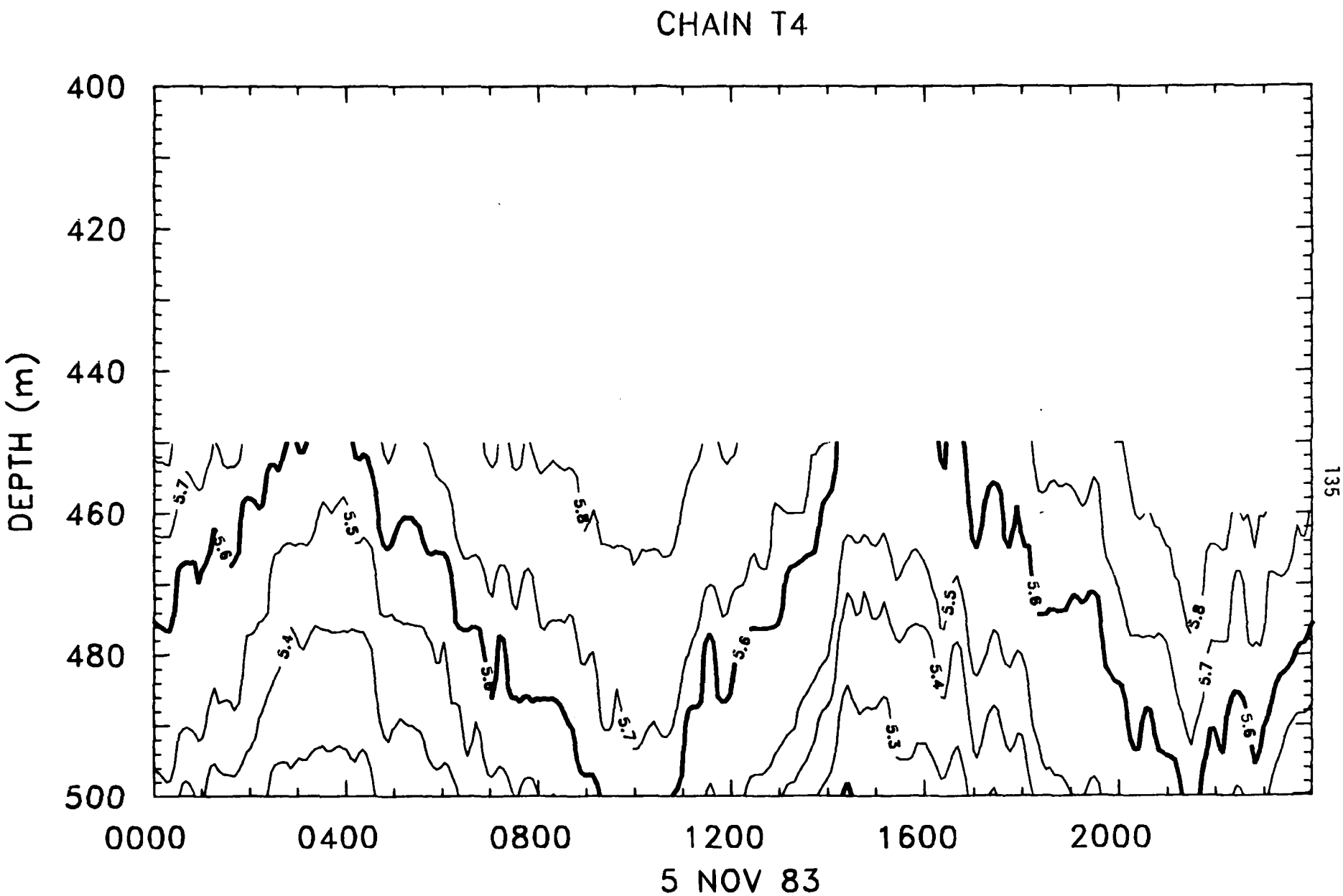
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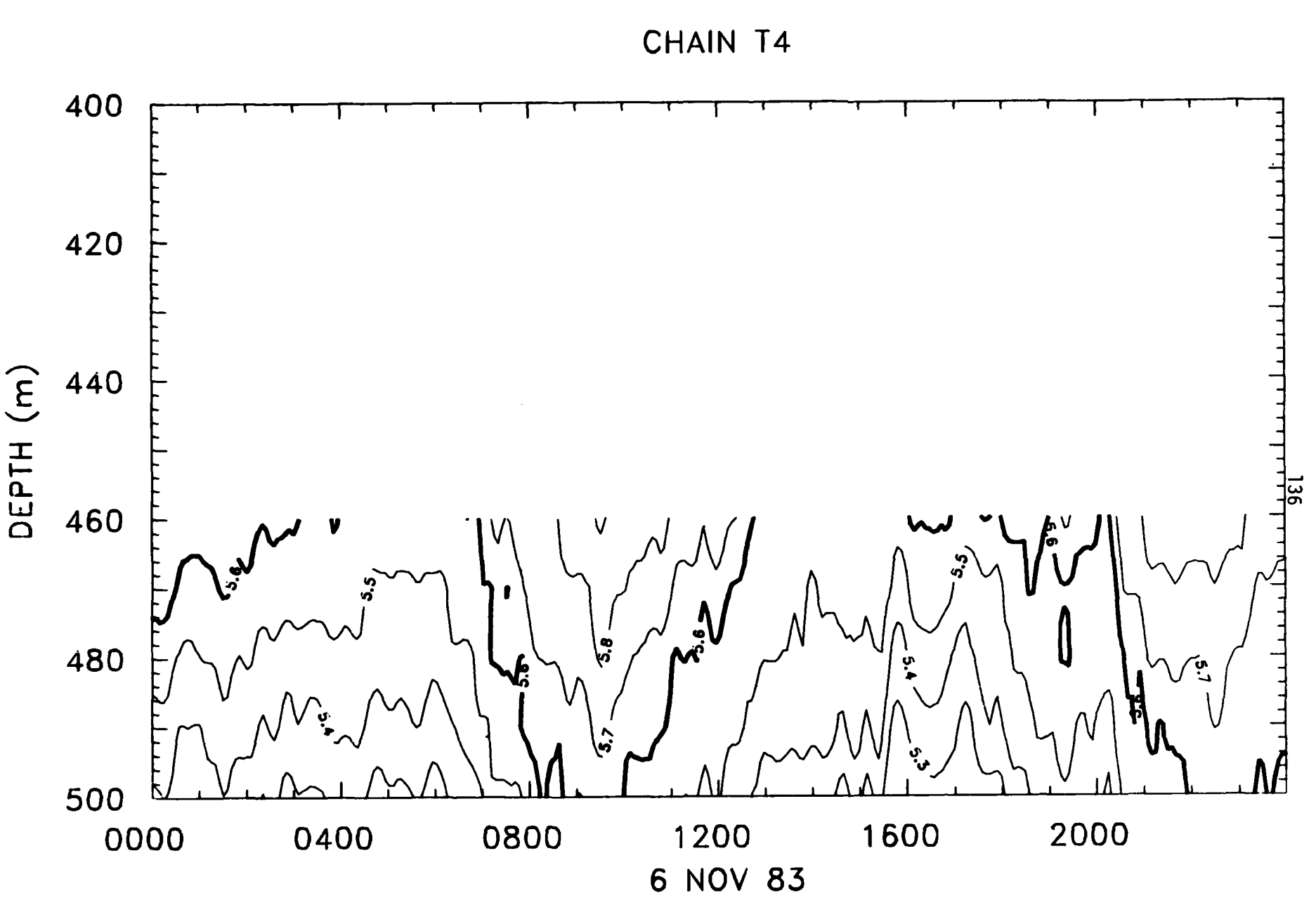
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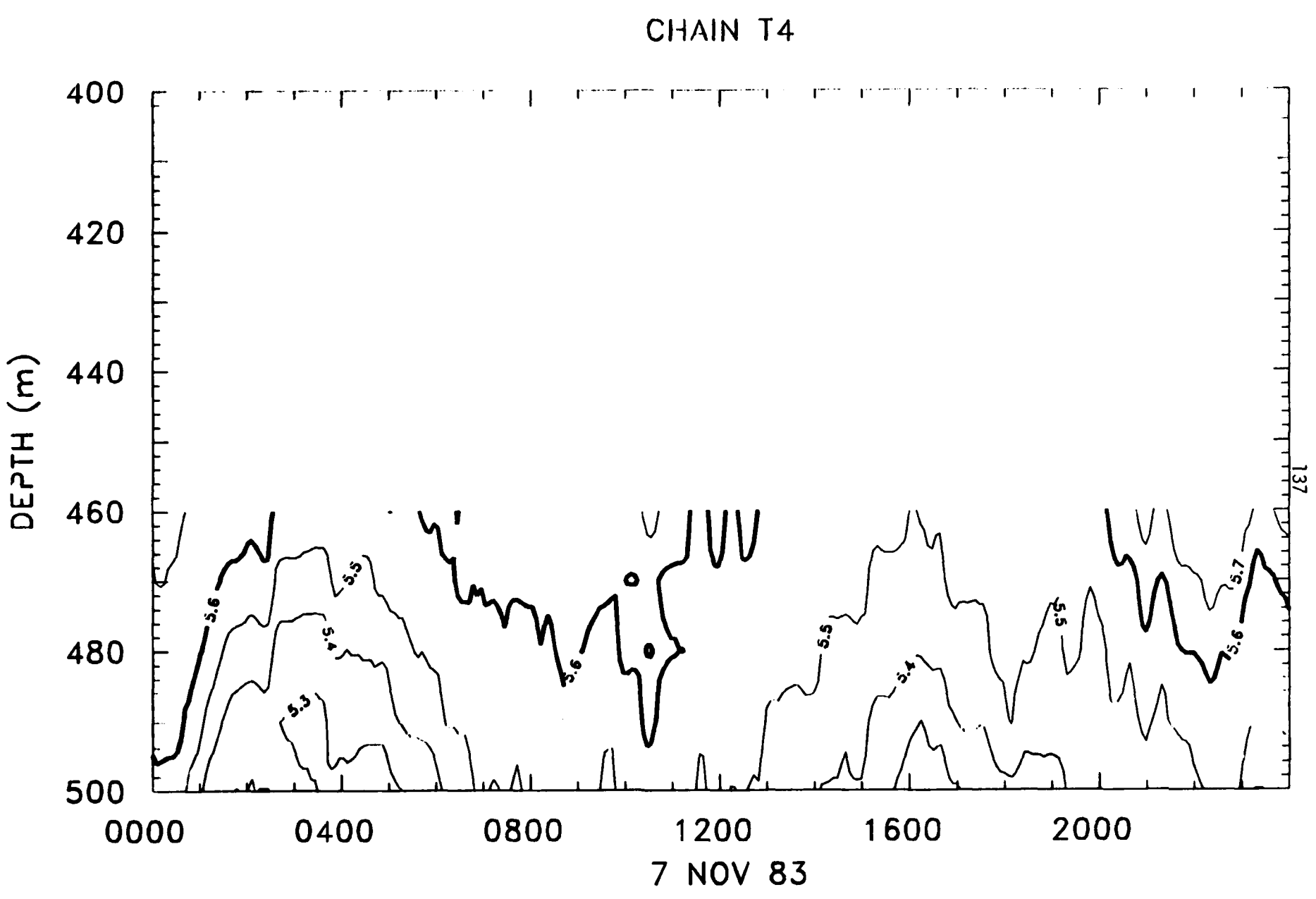
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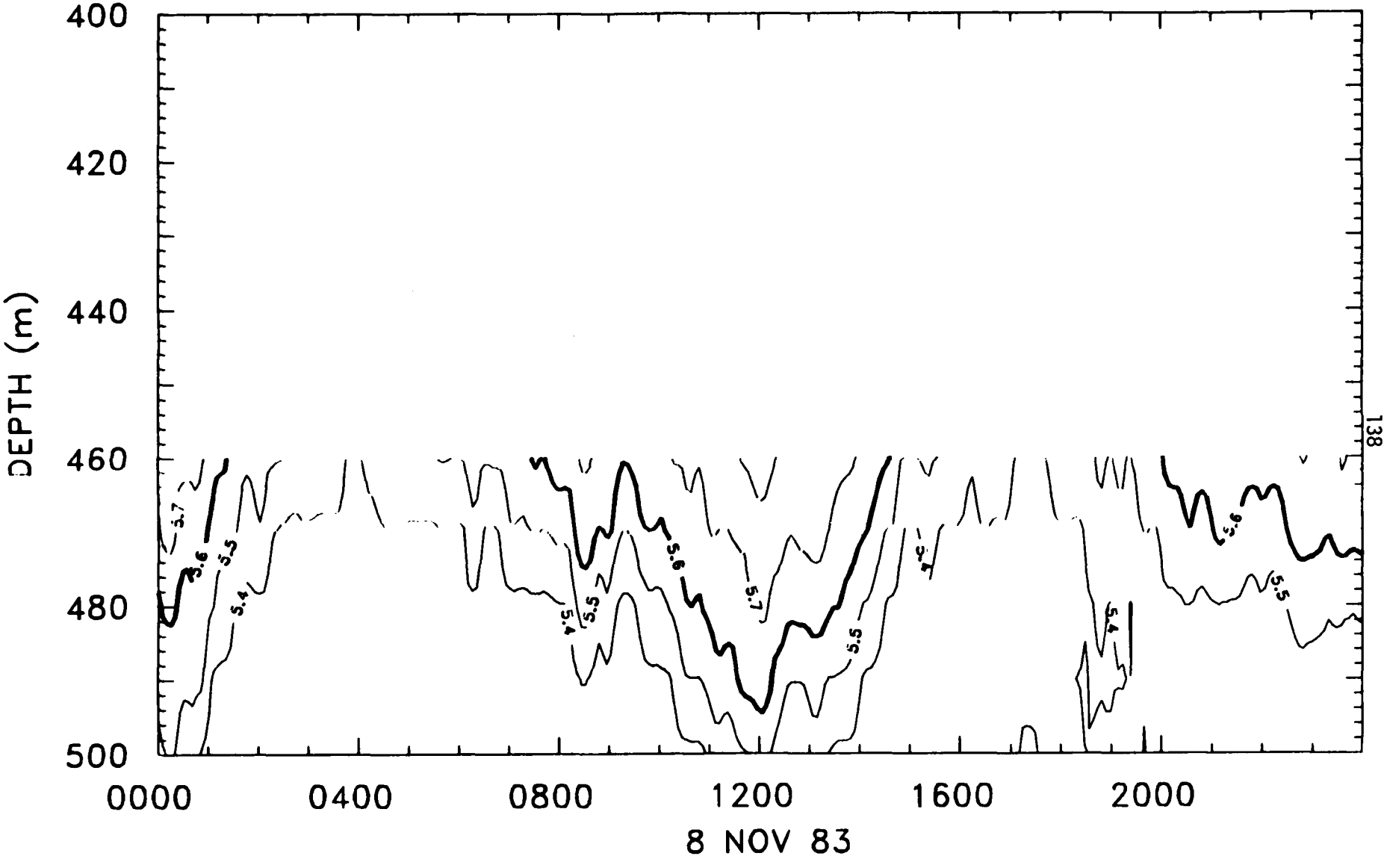
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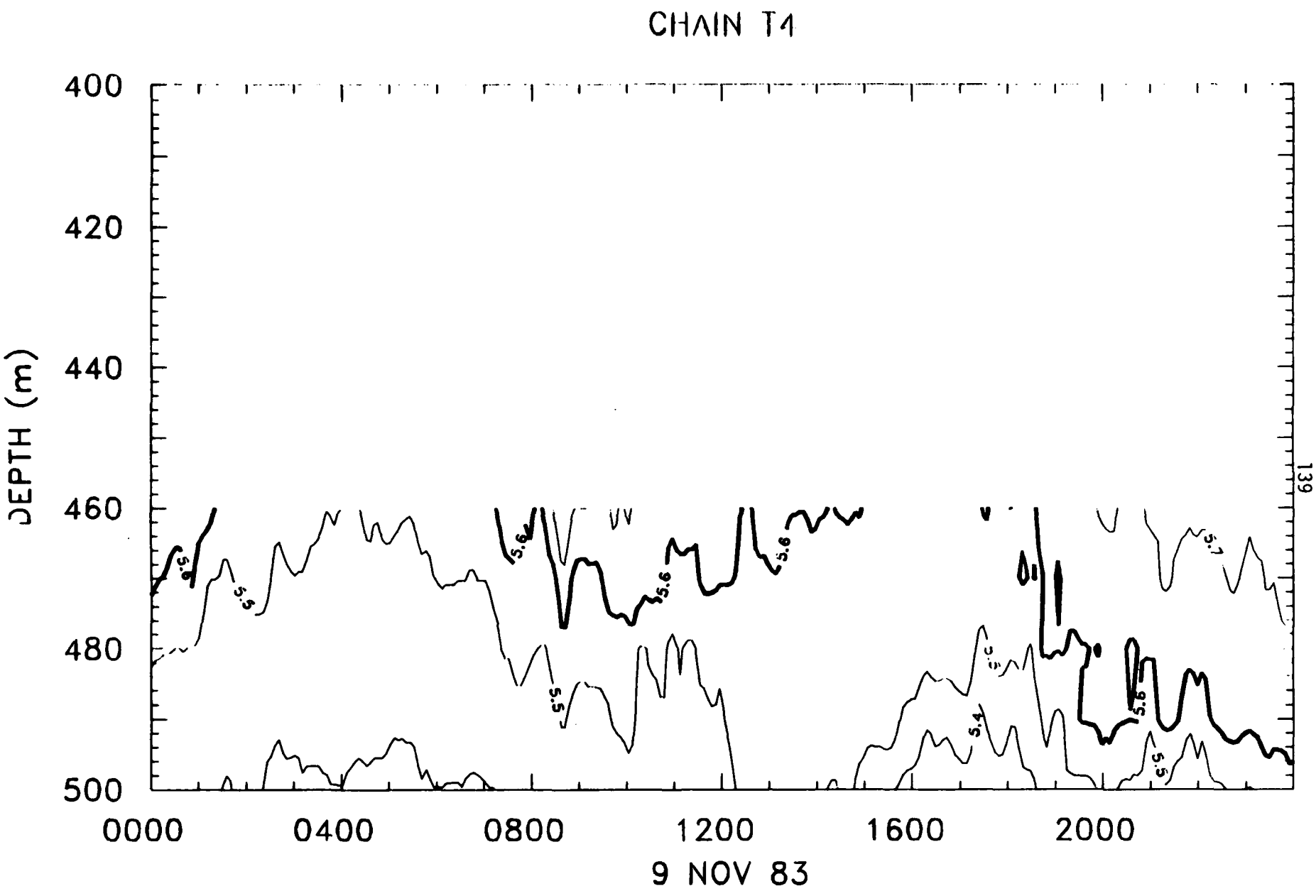
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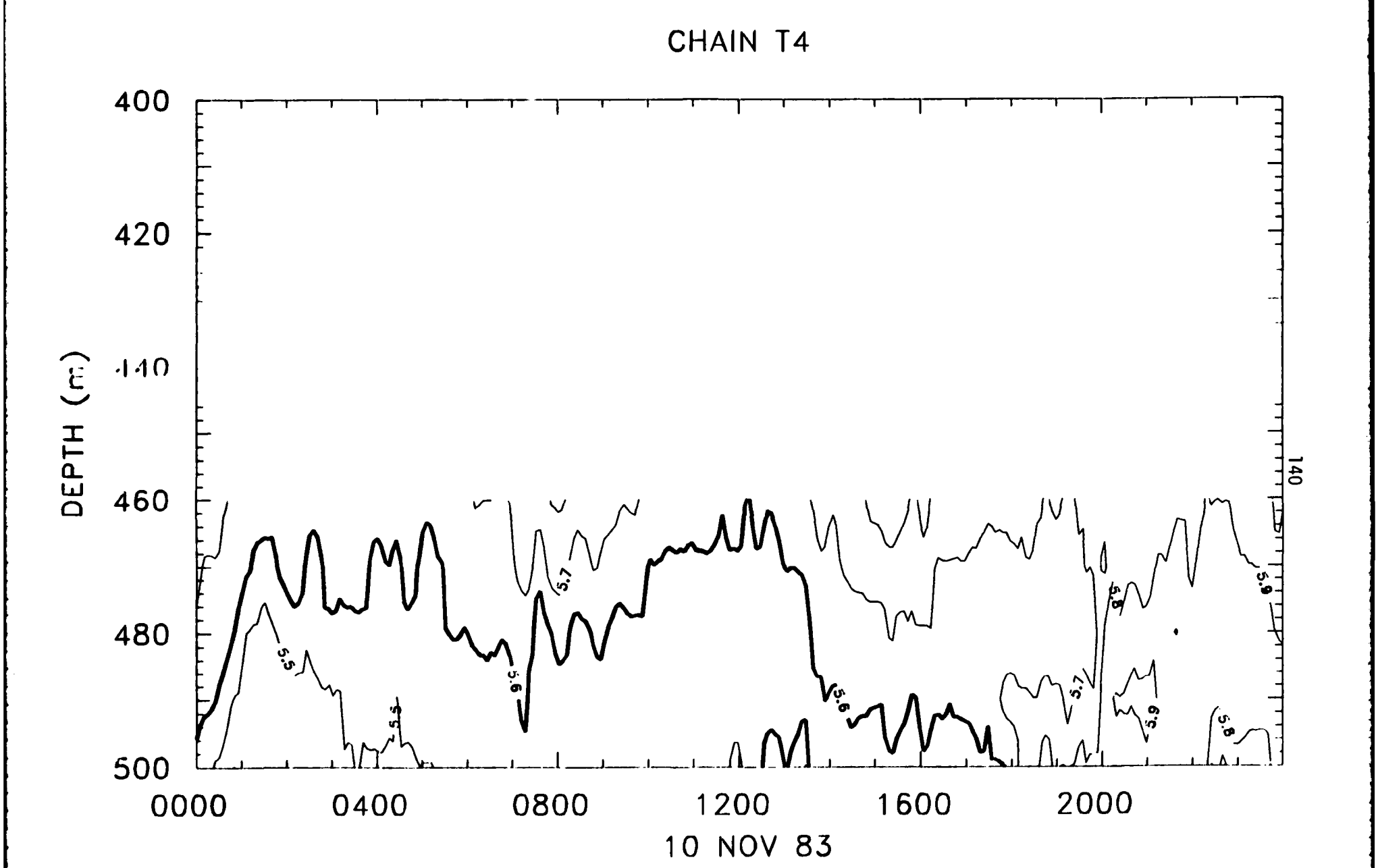
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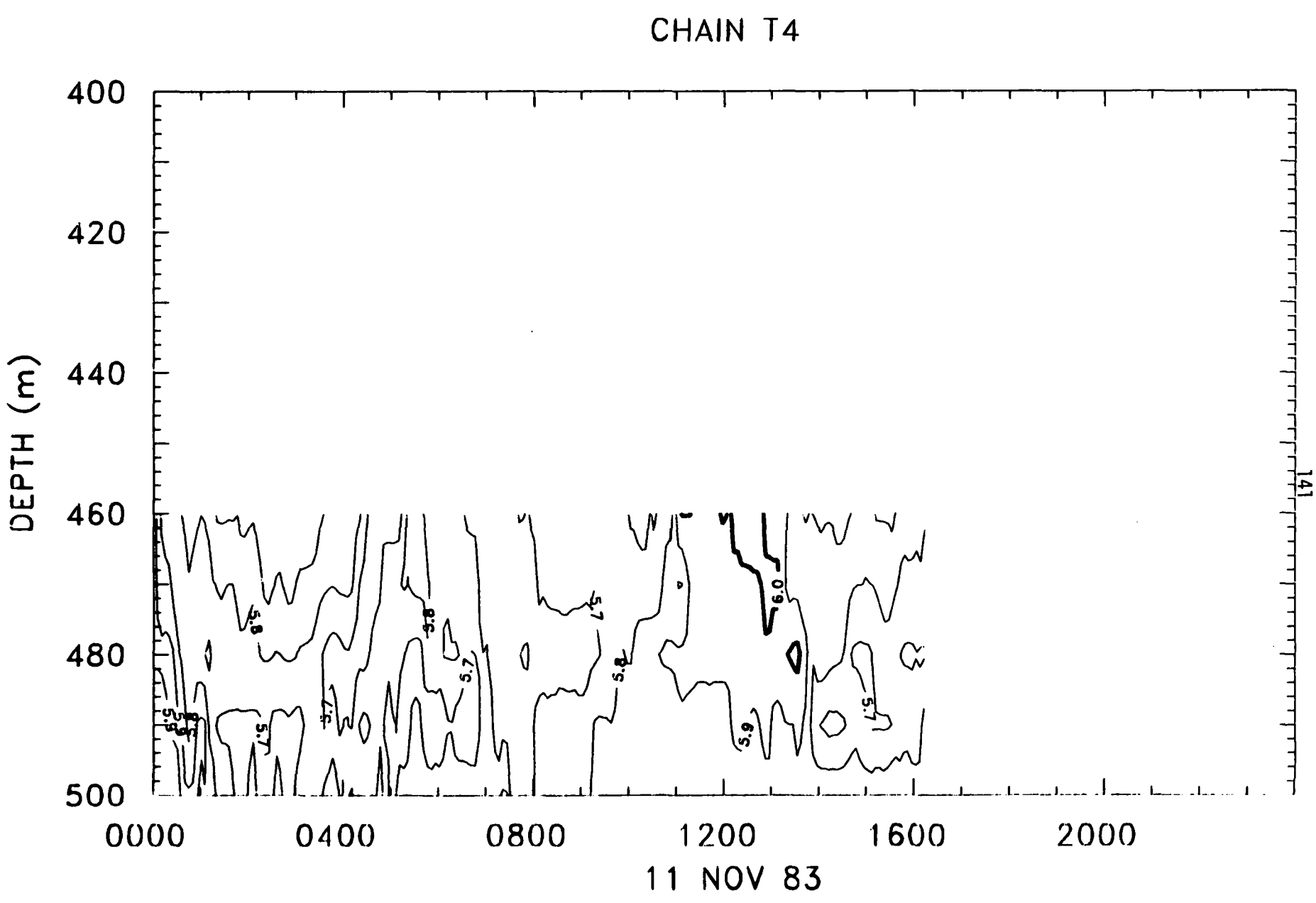
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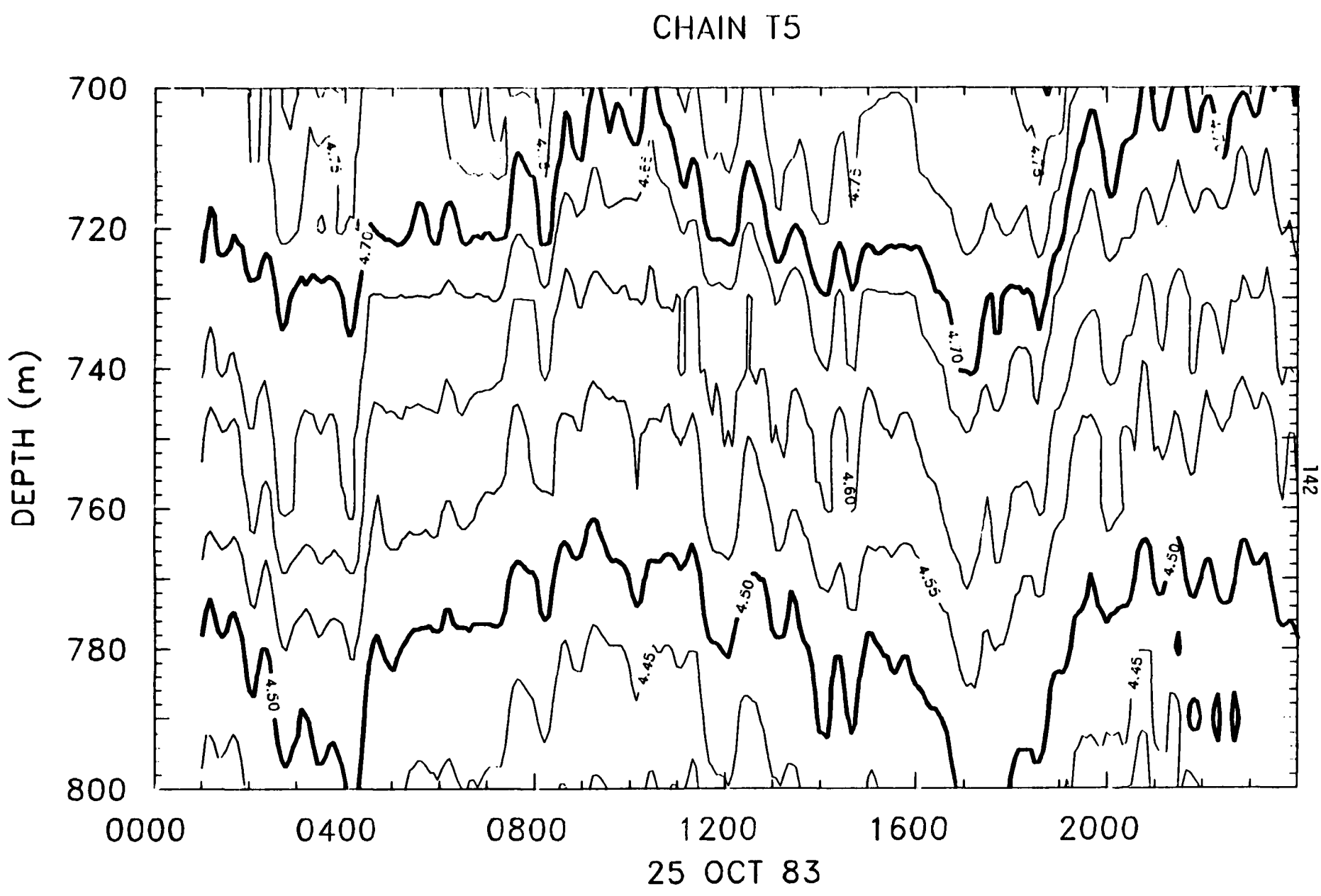
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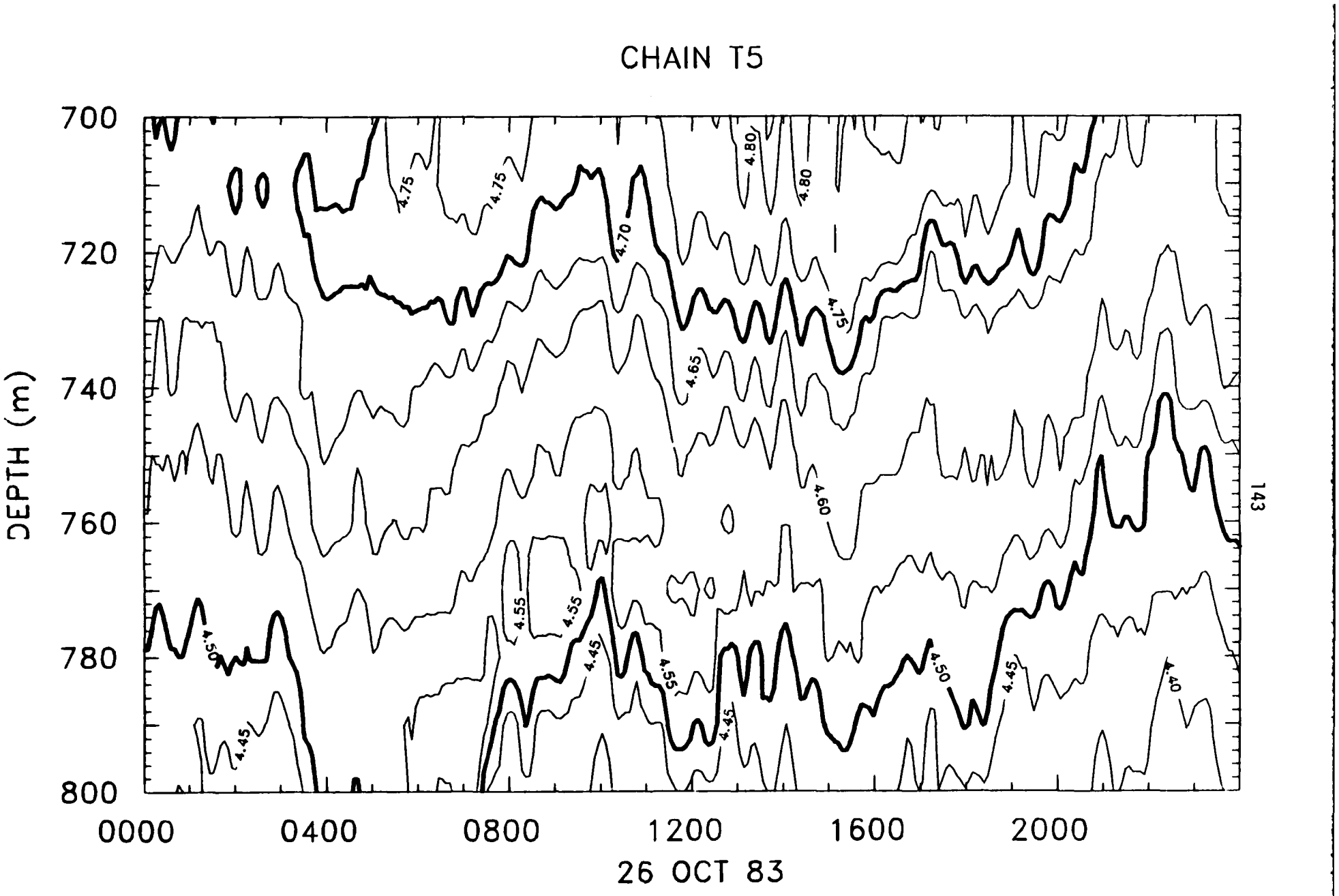
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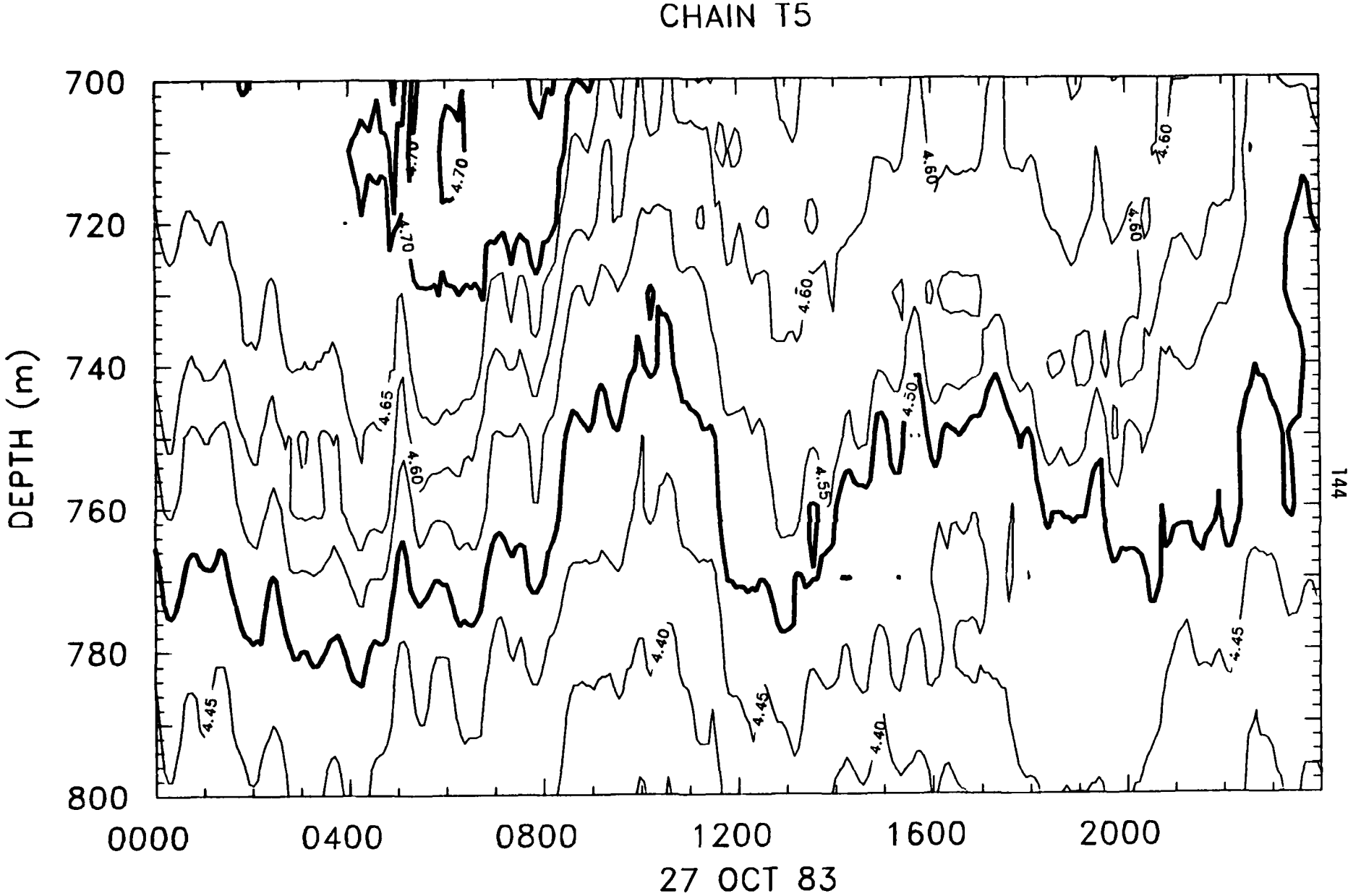
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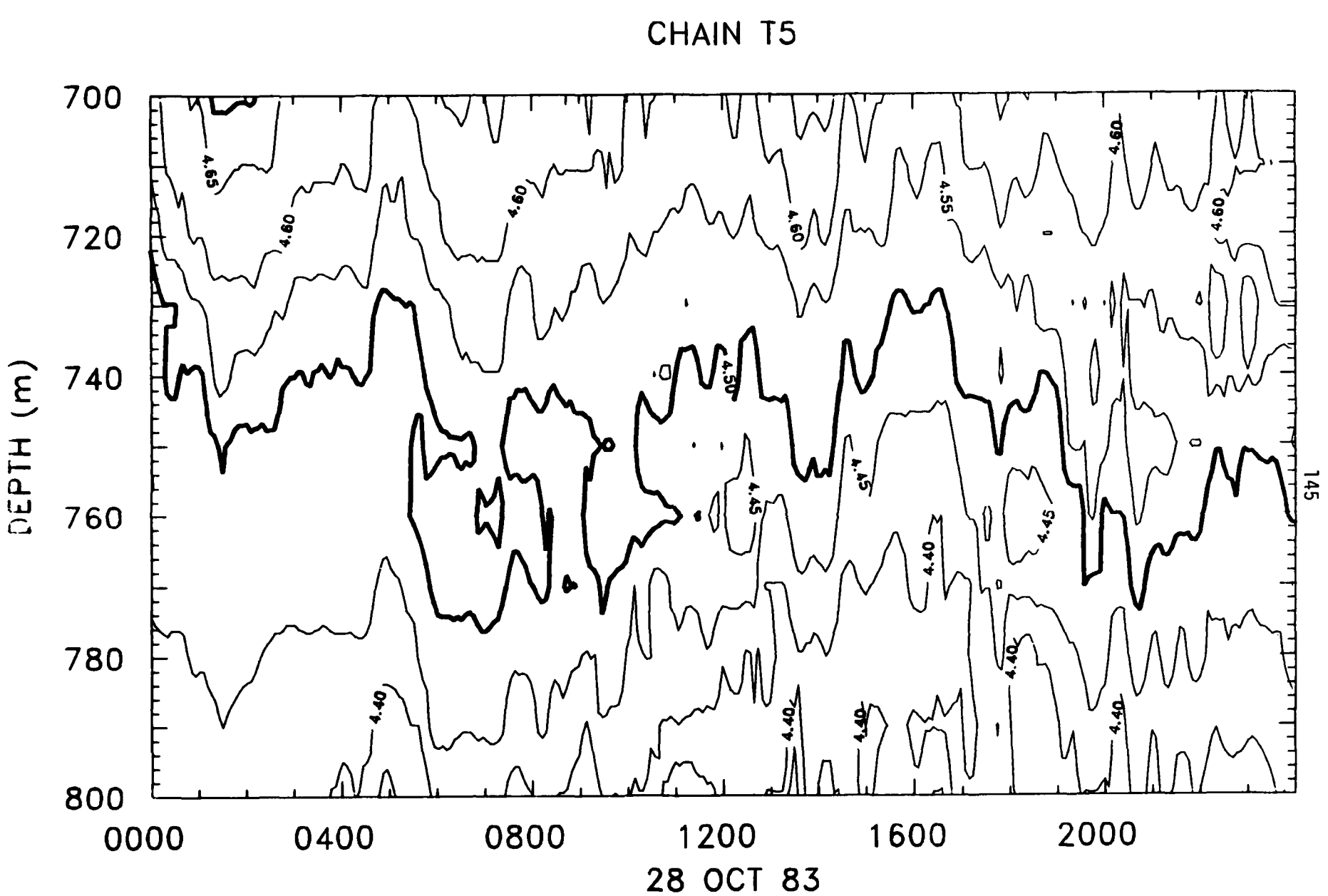
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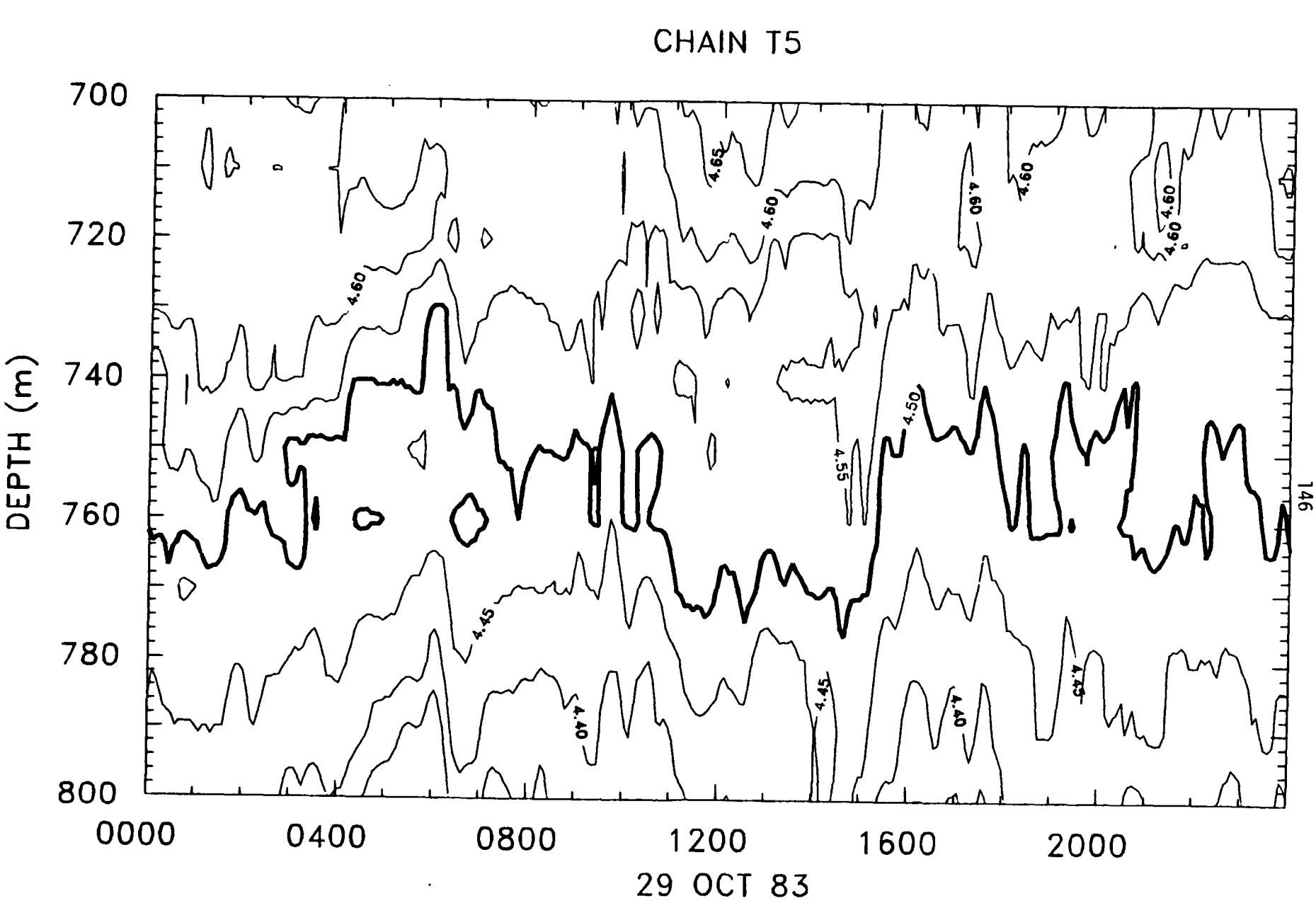
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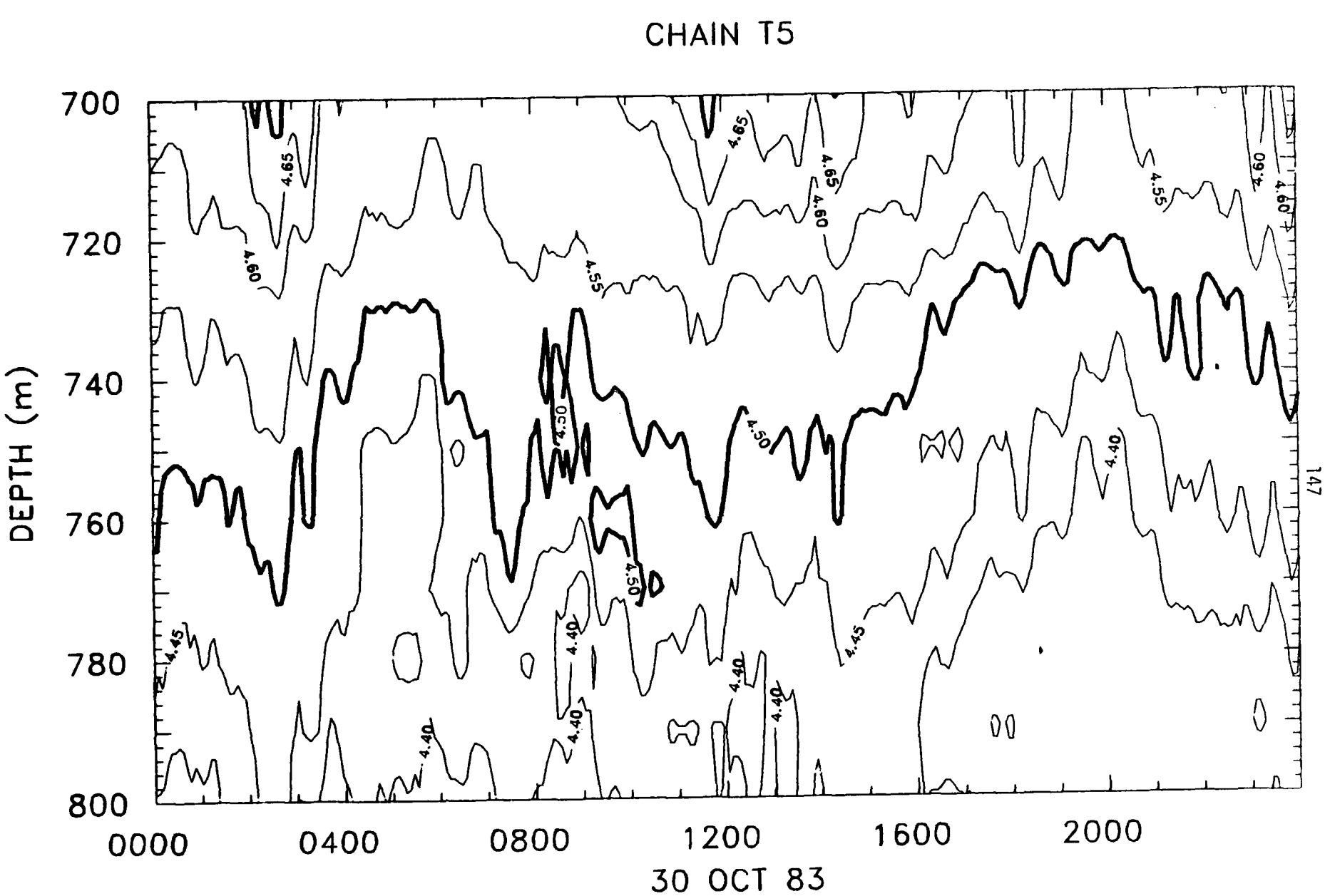
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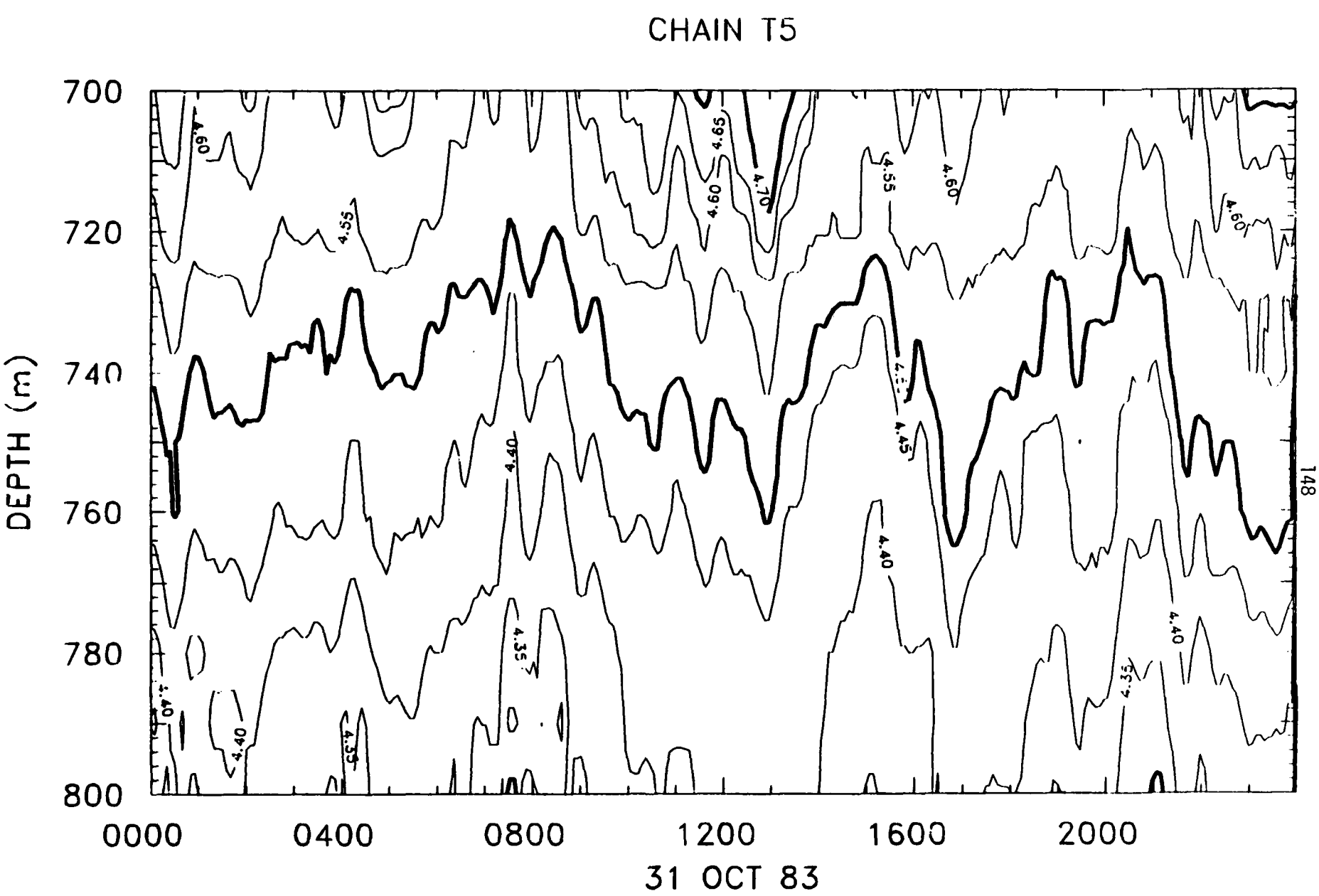
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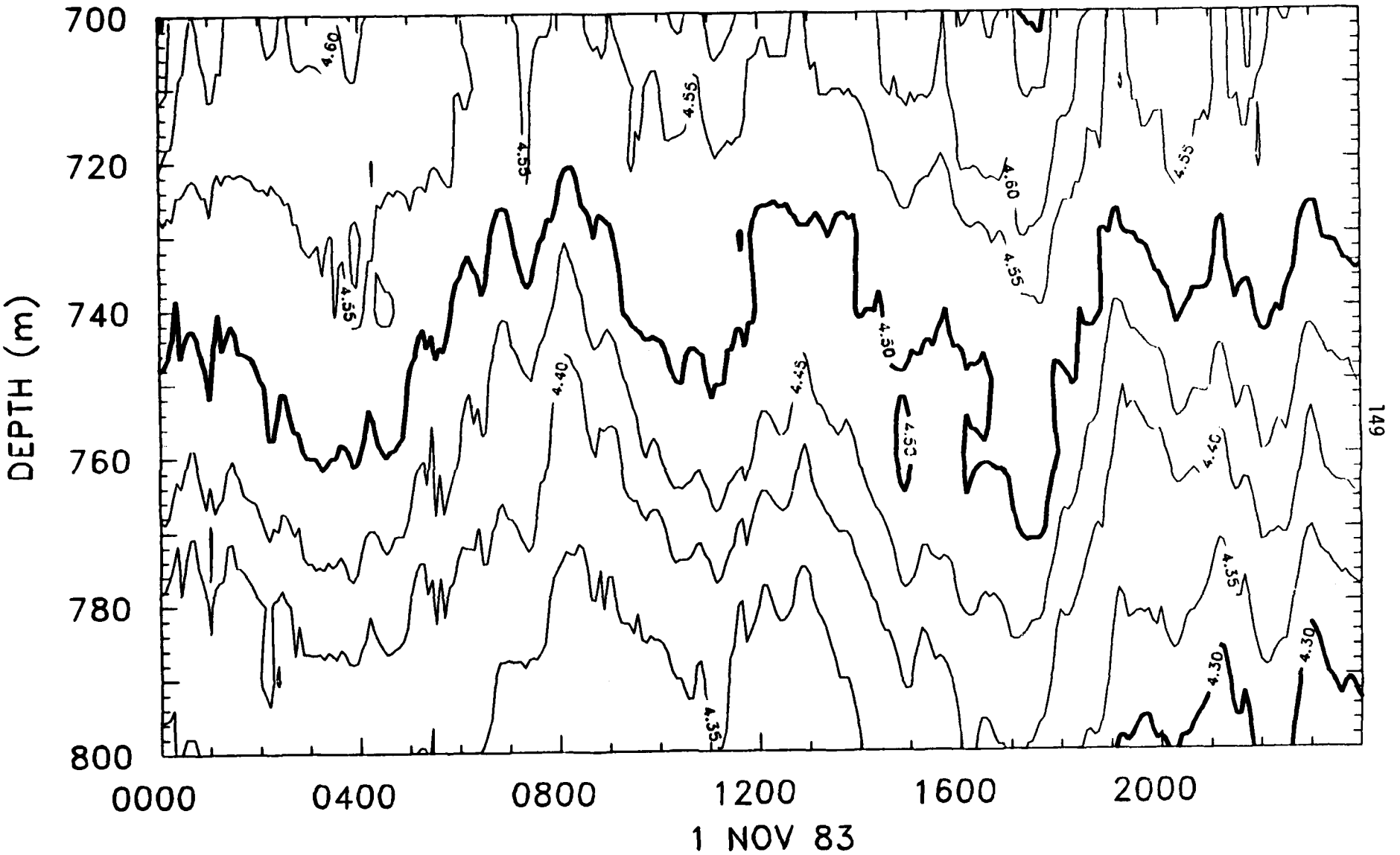
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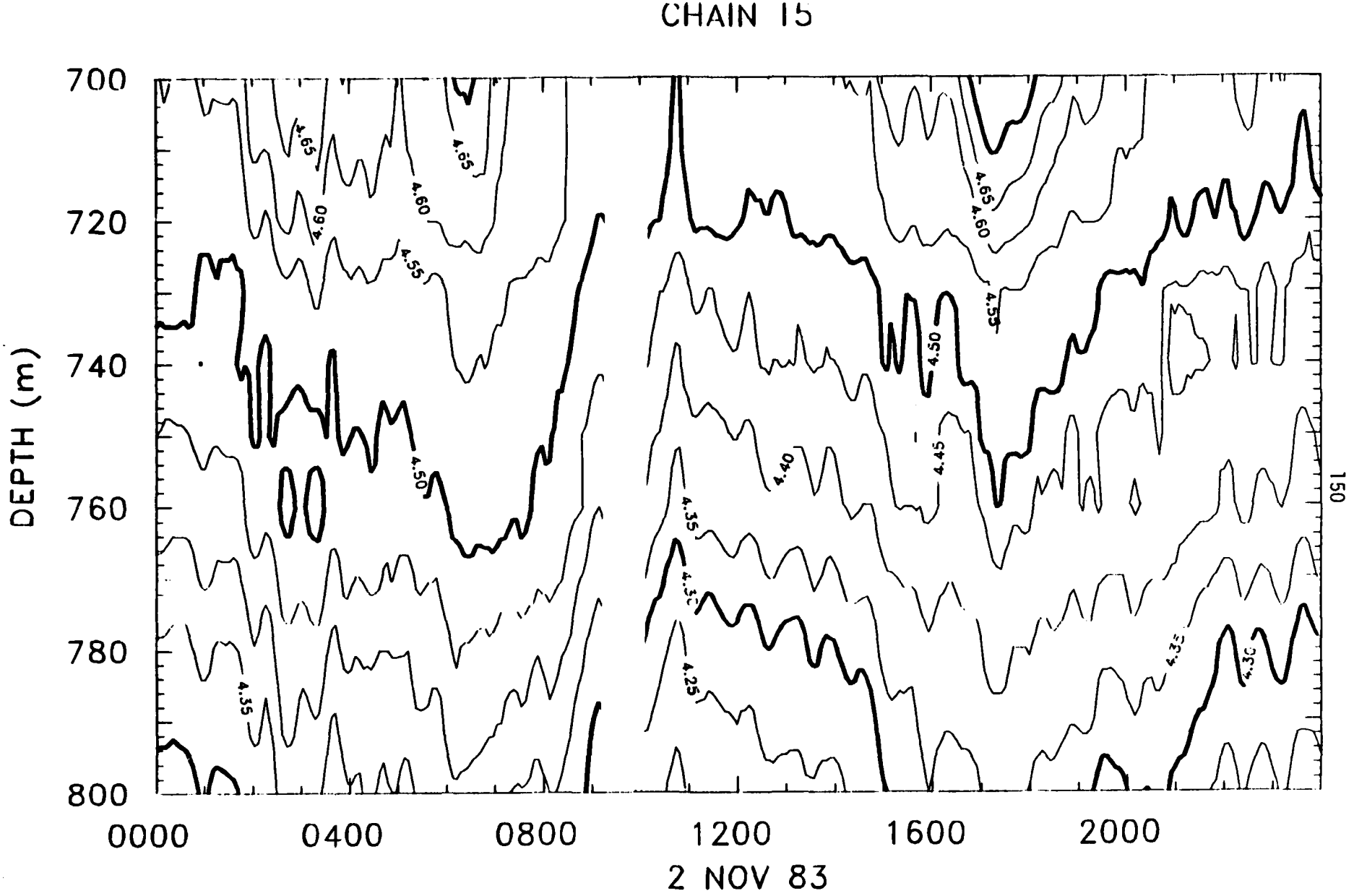
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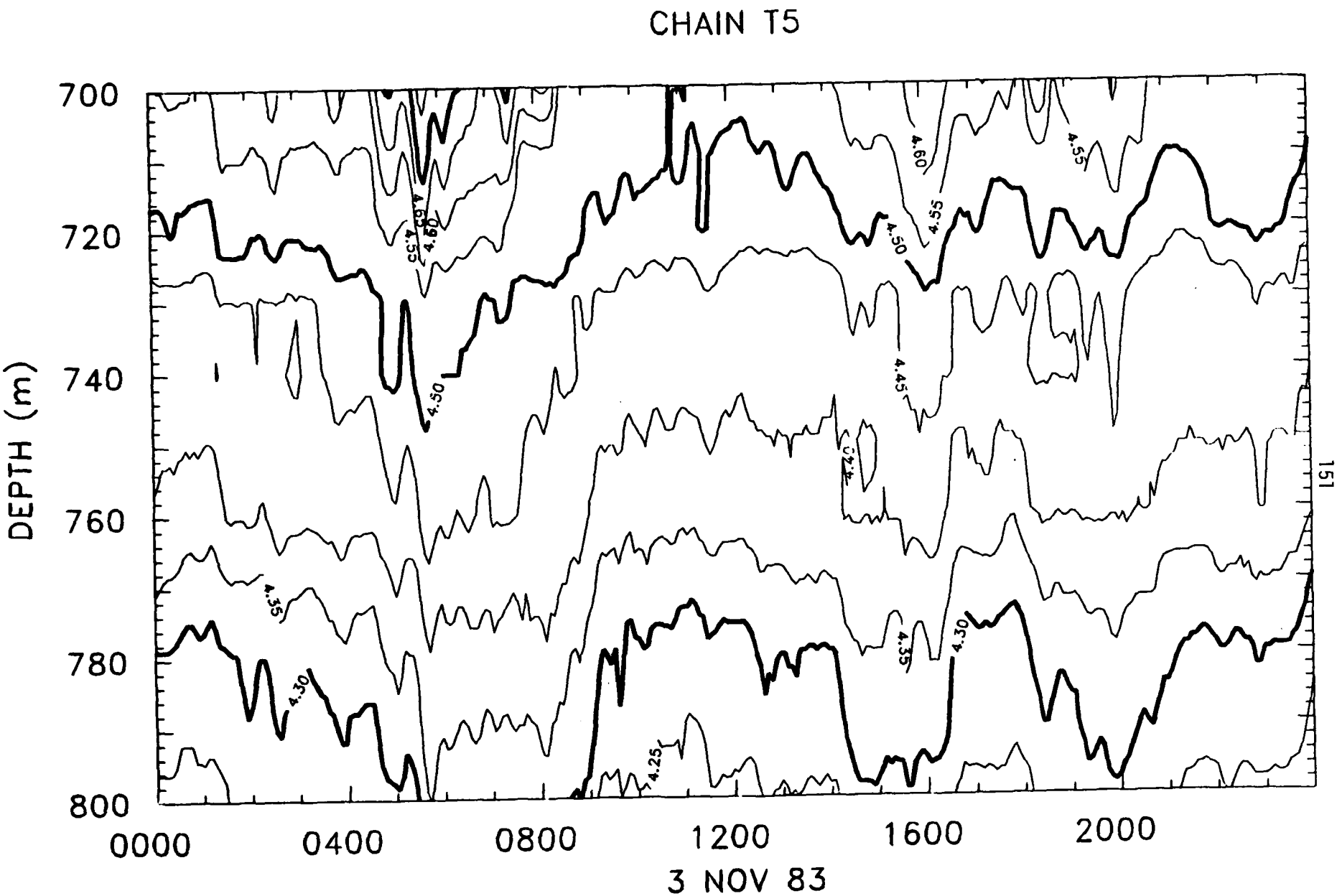
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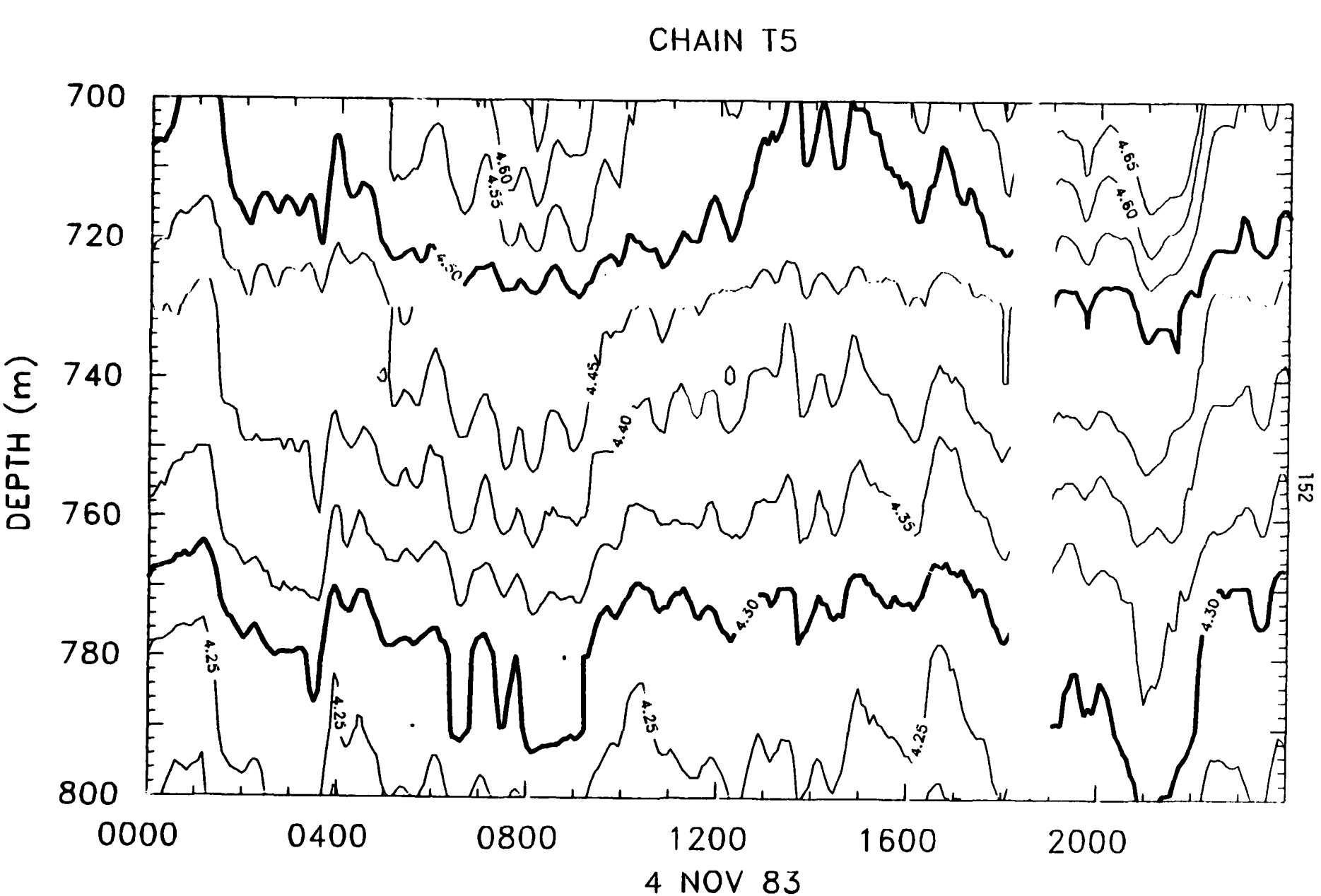
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DEPTH (m)
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760
780
800
0000
0400
0800
1200
1600
2000
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4.55
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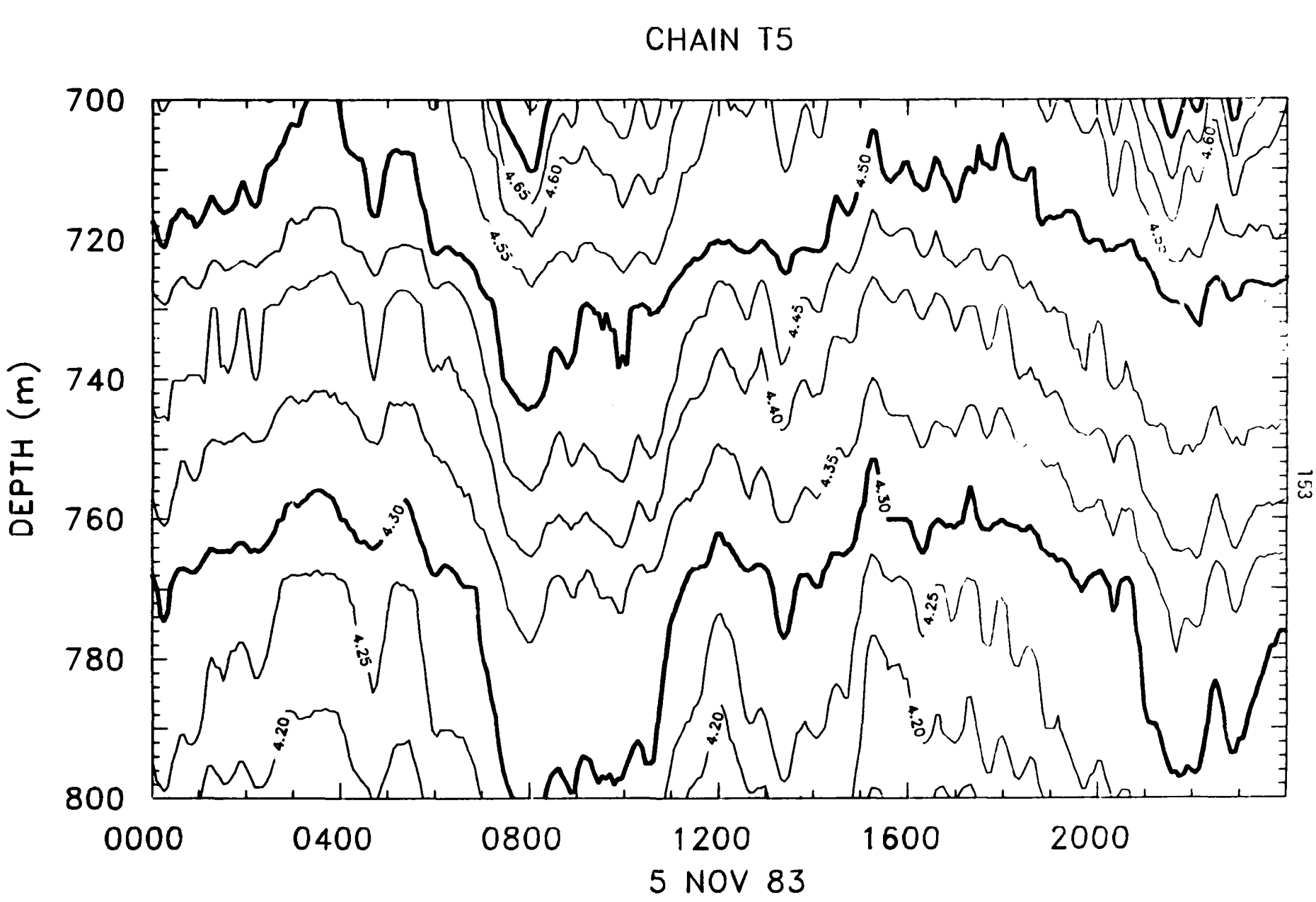
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DEPTH (m)
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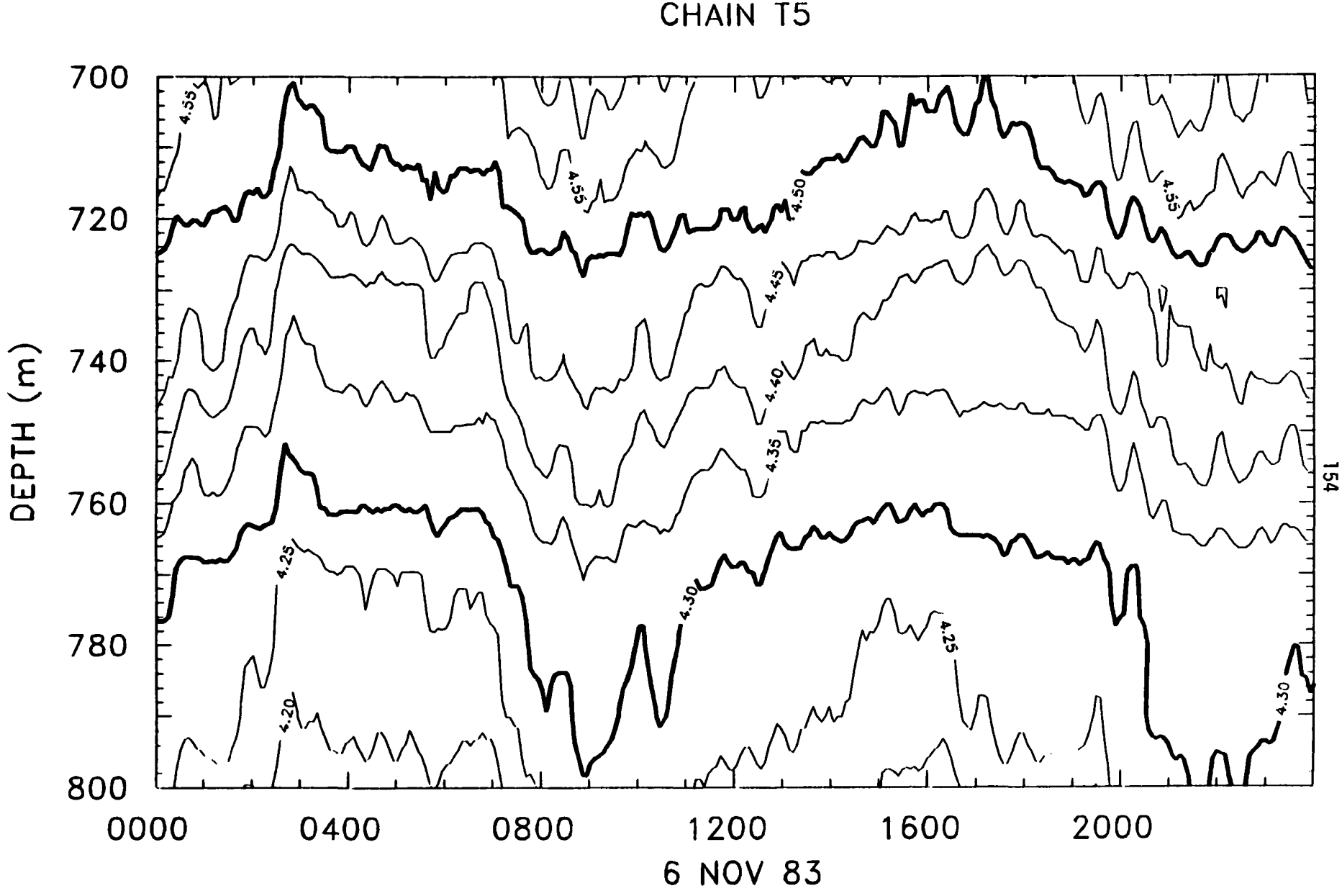
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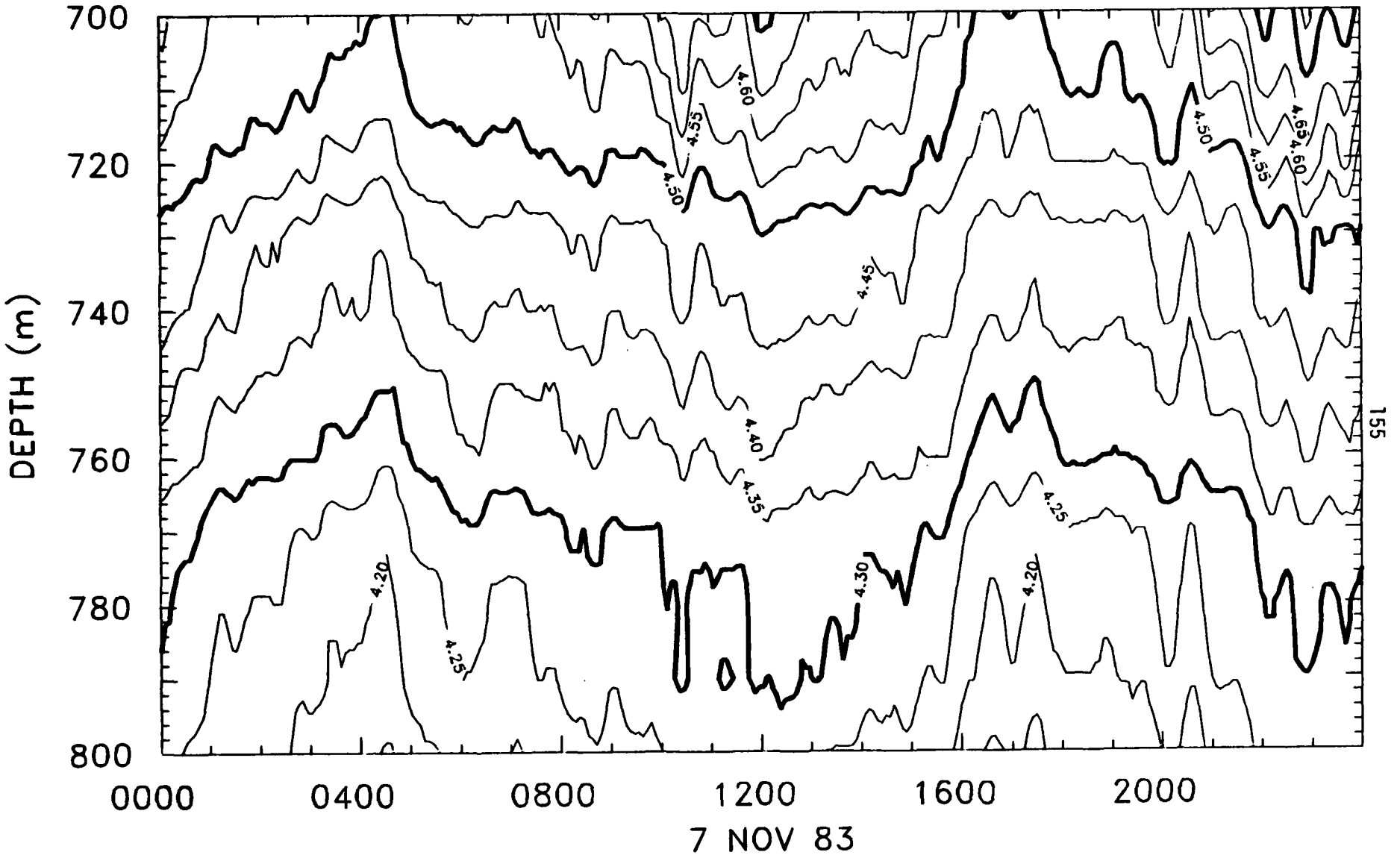
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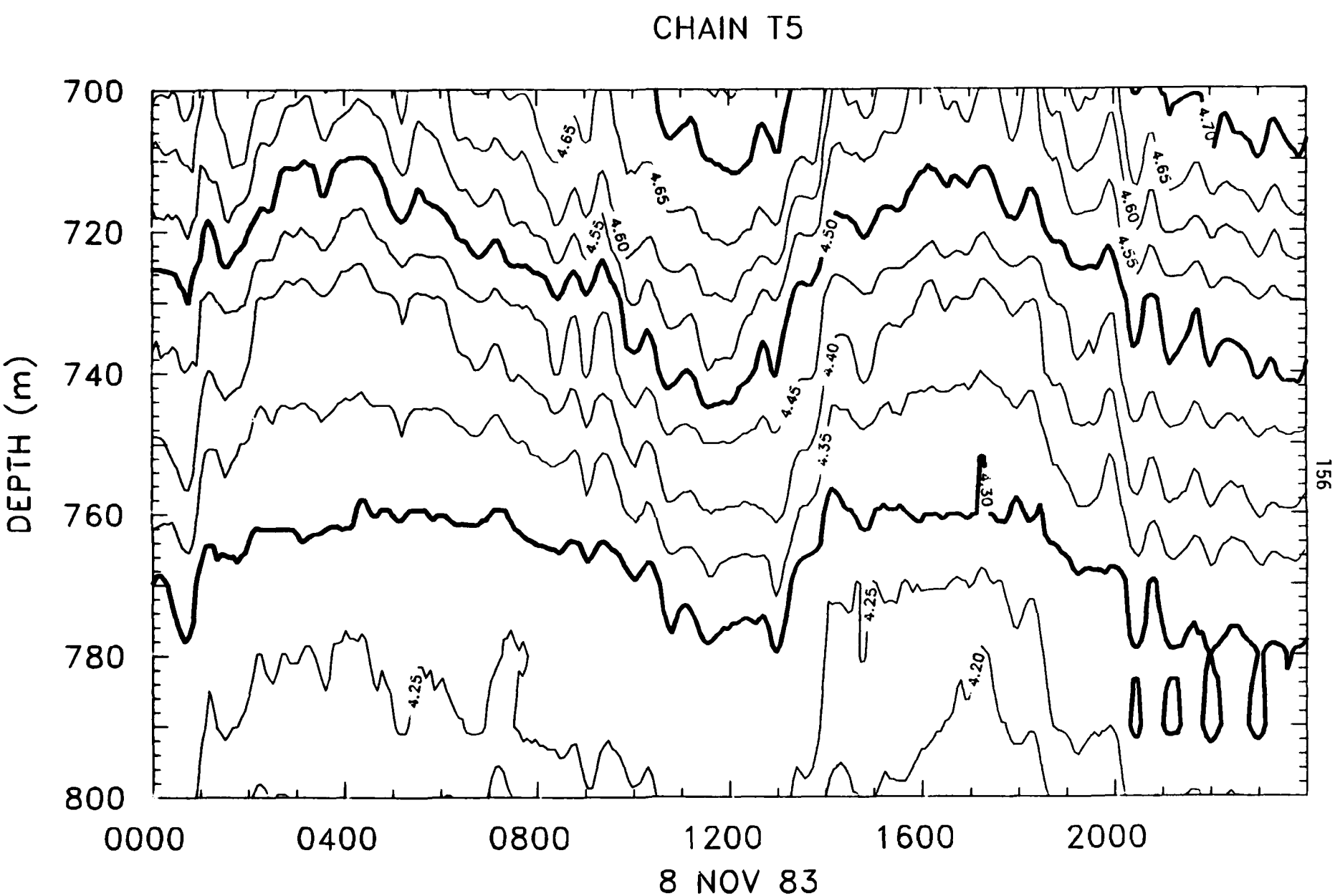
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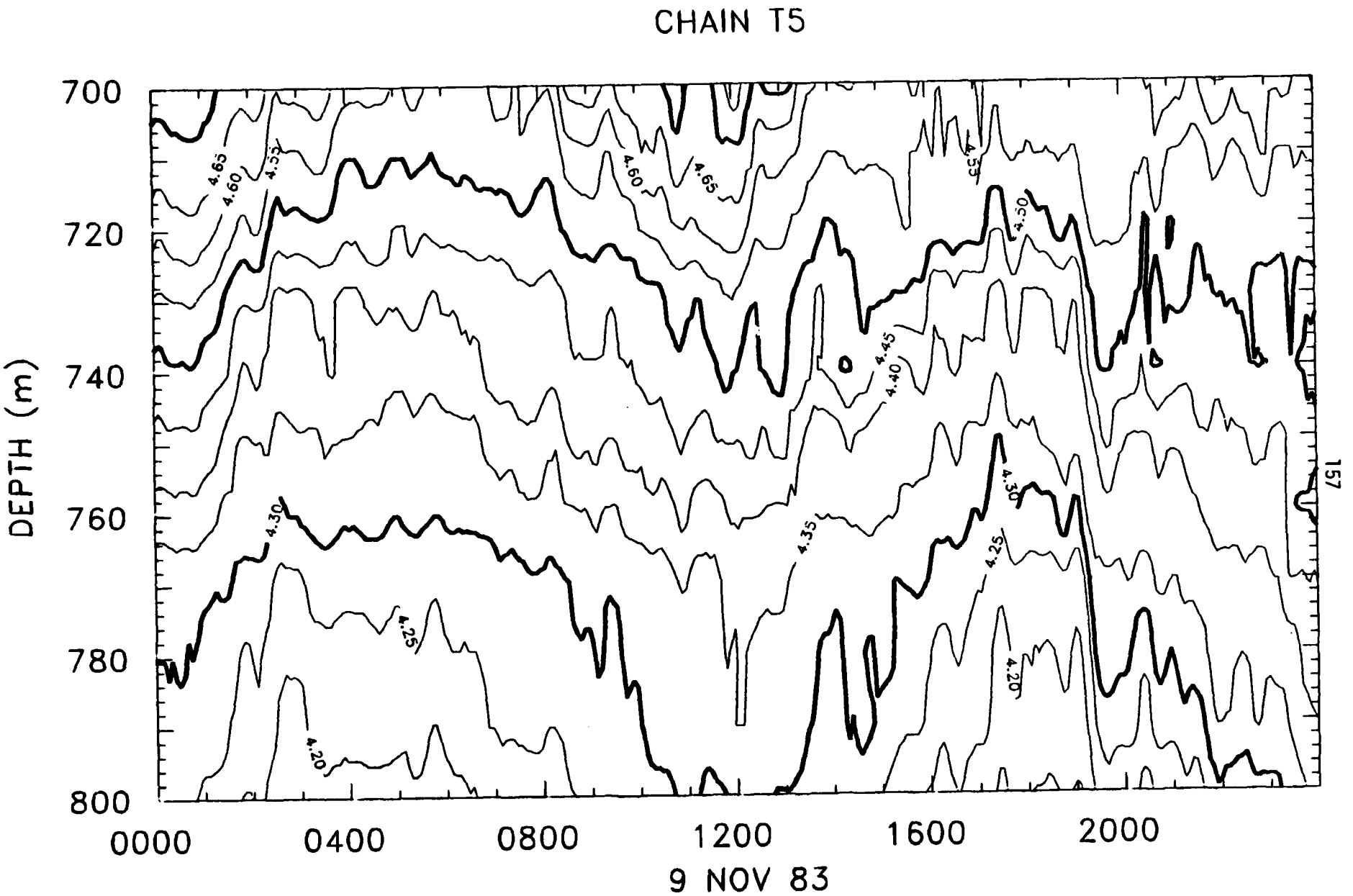
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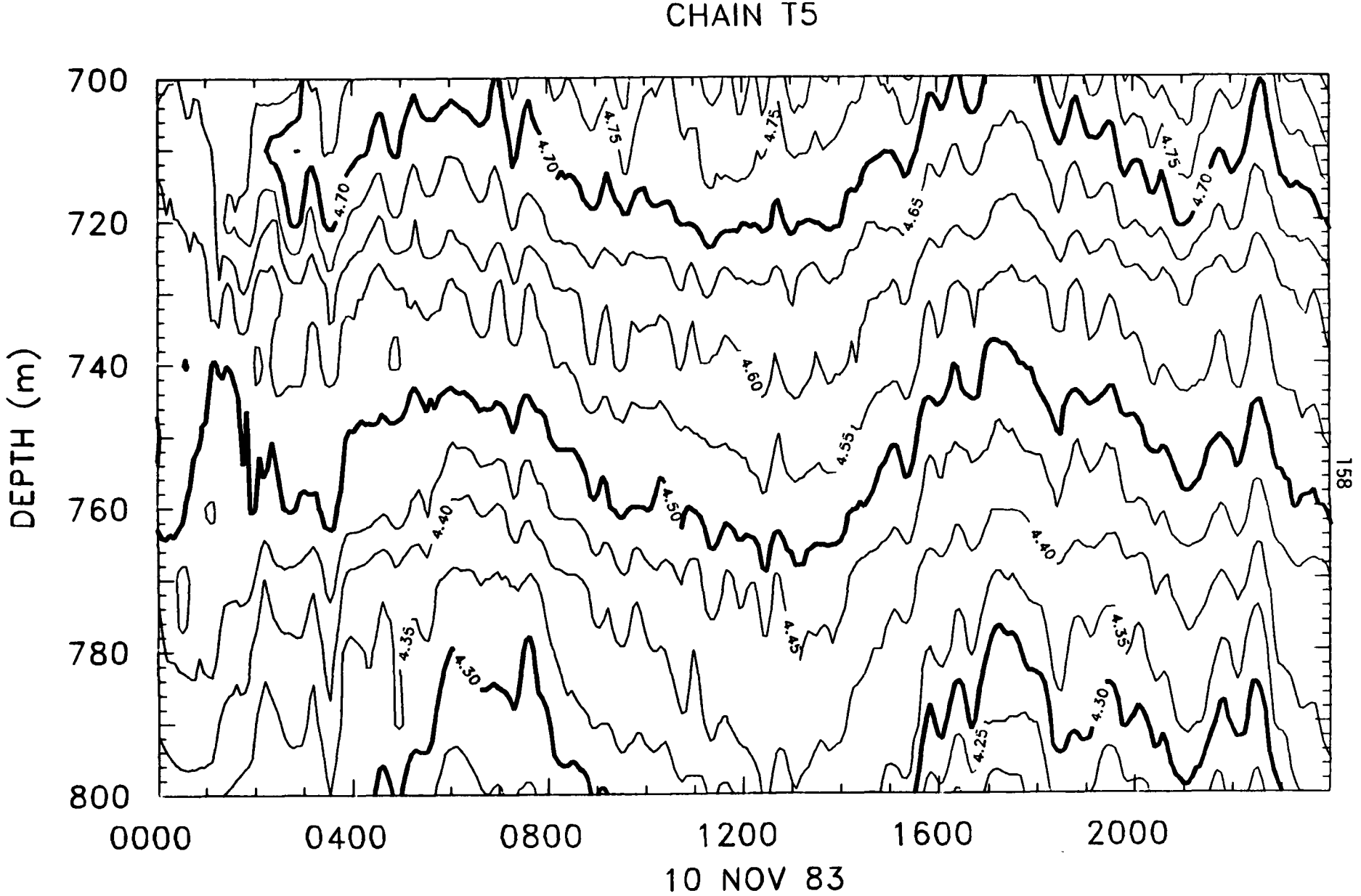
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DEPTH (m)
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2000
10 NOV 83
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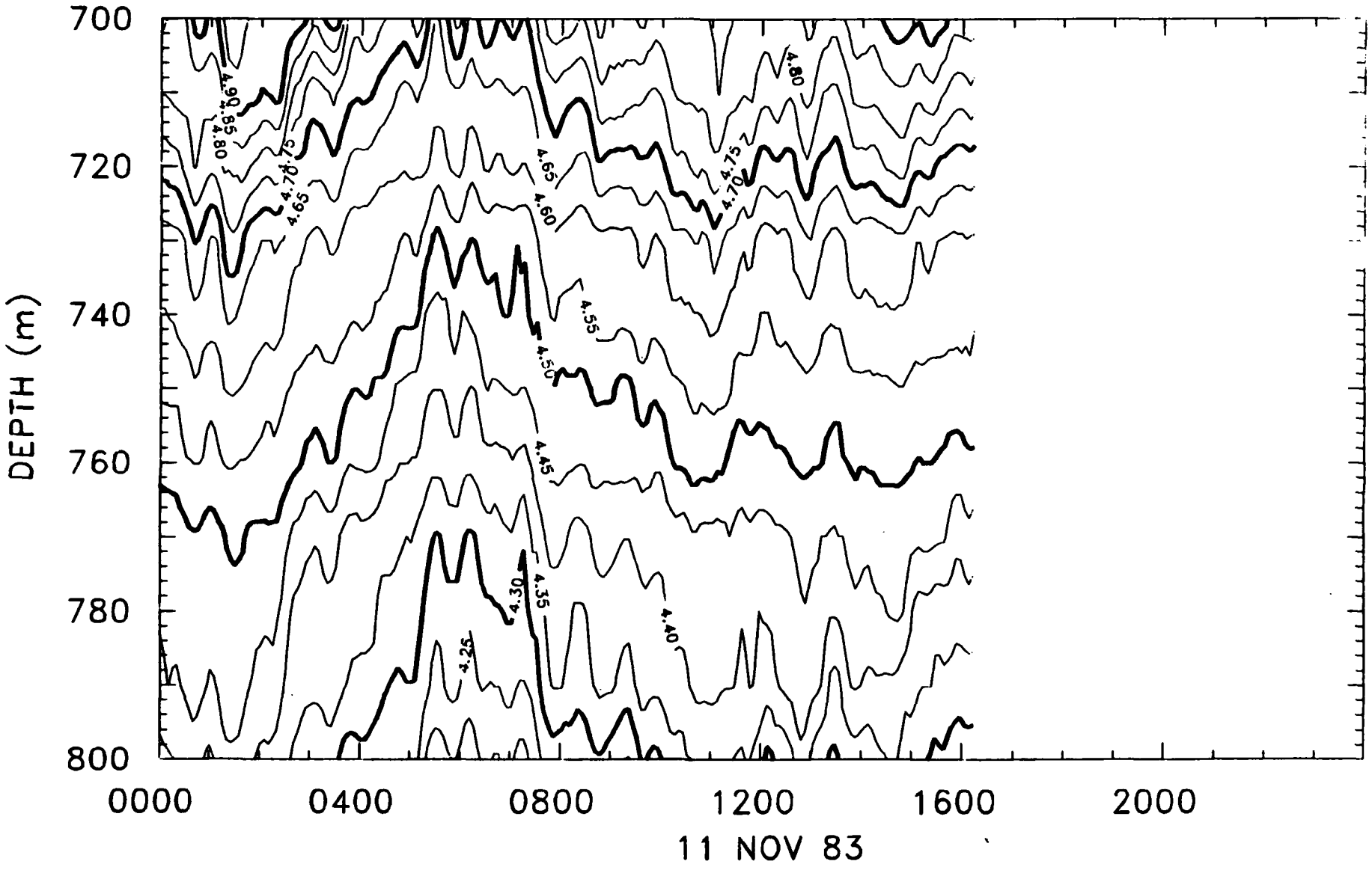
CHAIN T5
DEPTH (m)
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800
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11 NOV 83
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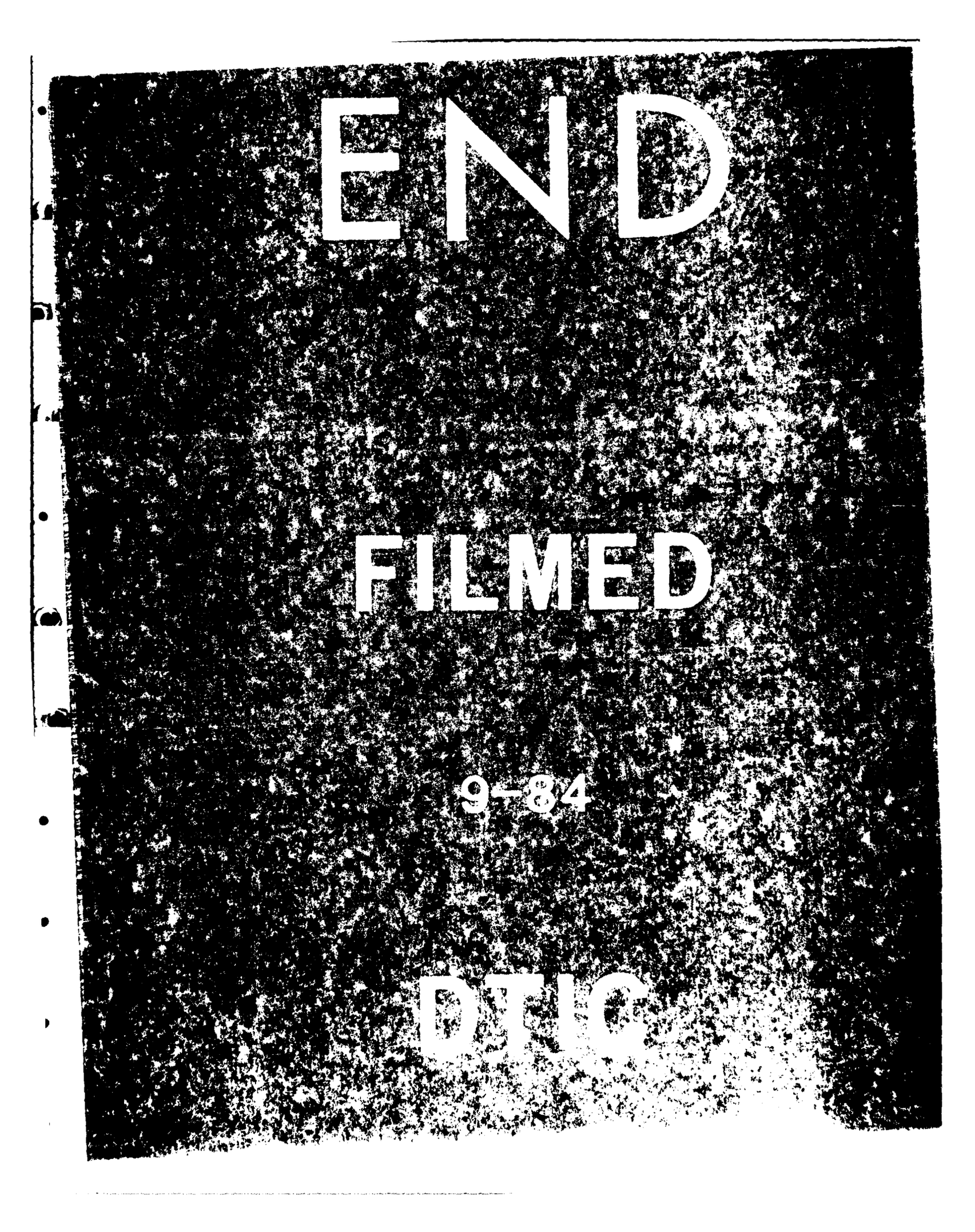
END
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